FURUNO

OPERATOR'S MANUAL

MARINE RADAR

MODEL MODEL1833/1933/1943

NAVnet

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

PRINTED IN JAPAN

© FURUNO ELECTRIC CO., LTD.

9-52, Ashihara-cho,
Nishinomiya, Japan

Telephone: 0798-65-2111
Telefax: 0798-65-4200

•Your Local Agent/Dealer

All rights reserved. Printed in Japan

FIRST EDITION : APR. 2001
D : OCT. 11, 2001

PUB. No. OME-35020
MODEL1833/1933/1943
(DAMI)

00080918600

OME35020D00

⚠ SAFETY INSTRUCTIONS

⚠ WARNING

ELECTRICAL SHOCK HAZARD
Do not open the equipment.

Only qualified personnel should work inside the equipment.

Turn off the radar power switch before servicing the antenna unit. Post a warning sign near the switch indicating it should not be turned on while the antenna unit is being serviced.

Prevent the potential risk of being struck by the rotating antenna and exposure to RF radiation hazard.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the switchboard if the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire or electrical shock. Contact a FURUNO agent for service.

Keep heater away from equipment.

A heater can melt the equipment's power cord, which can cause fire or electrical shock.

Use the proper fuse.

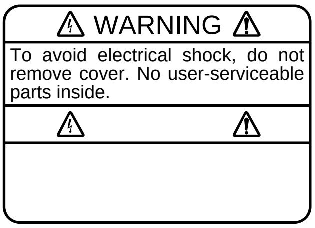
Fuse rating is shown on the power cable. Use of a wrong fuse can result in damage to the equipment.

⚠ CAUTION

No one navigation device should ever be solely replied upon for the navigation of a vessel.

Always confirm position against all available aids to navigation, for safety of vessel and crew.

A warning label is attached to the equipment. Do not remove the label. If the label is missing or damaged, contact a FURUNO agent or dealer about replacement.



Name: Warning Label (1)
Type: 86-003-1011-0
Code No.: 100-236-230

TABLE OF CONTENTS

FOREWORD ... viii
SYSTEM CONFIGURATIONS ... x

1. OPERATIONAL OVERVIEW ... 1-1
1.1 Operating Controls ... 1-2
1.1.1 Display unit controls ... 1-2
1.1.2 Remote controller ... 1-5
1.2 Inserting a Chart Card ... 1-6
1.3 Turning the Unit On/Off ... 1-7
1.4 Display Brilliance, Panel Brilliance, Brilliance Boost, Economy Mode ... 1-8
1.4.1 Display brilliance, panel brilliance ... 1-8
1.4.2 Brilliance boost ... 1-9
1.4.3 Economy mode ... 1-9
1.5 Selecting a Display ... 1-10
1.5.1 Display modes ... 1-10
1.5.2 Selecting a display ... 1-11
1.5.3 Switching control in combination screens ... 1-12
1.5.4 Selecting image source ... 1-13
1.6 Trackball, Cursor ... 1-14
1.7 Entering the MOB Mark, Setting MOB as Destination ... 1-15
1.8 Data Boxes ... 1-16
1.8.1 Showing, hiding data boxes with soft key ... 1-16
1.8.2 Rearranging data boxes ... 1-16
1.8.3 Temporarily erasing a data box ... 1-16
1.9 Function Keys ... 1-17
1.9.1 Executing a function ... 1-17
1.10 Simulation Display ... 1-18

2. RADAR OPERATION ... 2-1
2.1 Radar Display ... 2-1
2.2 Transmitting, Stand-by ... 2-2
2.3 Tuning ... 2-2
2.4 Adjusting the Gain ... 2-2
2.5 Reducing Sea Clutter ... 2-4
2.5.1 How the A/C SEA works ... 2-4
2.5.2 Adjusting the A/C SEA ... 2-4
2.6 Reducing Precipitation Clutter ... 2-5
2.6.1 Adjusting the A/C RAIN ... 2-5
2.7 Range Scale ... 2-6
2.8 Pulselength ... 2-7
2.9 Presentation Mode ... 2-8
2.9.1 Selecting a presentation mode ... 2-8
2.9.2 Description of presentation modes ... 2-9

2.10 Measuring the Range..2-11
2.10.1 Measuring range by range rings..2-11
2.10.2 Measuring range by cursor..2-12
2.10.3 Measuring range by VRM..2-13
2.10.4 Erasing a VRM, VRM indication..2-14
2.10.5 Erasing EBL/VRM data boxes..2-14
2.10.6 Hiding EBL/VRM data boxes..2-14
2.10.7 Moving EBL/VRM data boxes..2-14
2.11 Measuring the Bearing..2-15
2.11.1 Measuring bearing by cursor..2-15
2.11.2 Measuring bearing by EBL..2-15
2.11.3 Erasing an EBL, EBL indication..2-16
2.11.4 Erasing EBL/VRM data boxes..2-16
2.11.5 Hiding EBL/VRM data boxes..2-16
2.11.6 Moving EBL/VRM data boxes..2-16
2.12 Erasing the Heading Line, North Marker..2-16
2.13 Reducing Noise Interference..2-17
2.14 Rejecting Radar Interference..2-18
2.15 Zoom..2-19
2.15.1 Zooming in on radar targets..2-19
2.15.2 Zooming in on ARP, TTM targets..2-19
2.16 Shifting the Picture..2-20
2.16.1 Manual shift..2-20
2.16.2 Automatic shift..2-21
2.17 Using the Offset EBL..2-22
2.17.1 Predicting collision course..2-22
2.17.2 Measuring range & bearing between two targets..2-23
2.18 Echo Trails..2-24
2.18.1 Trail time..2-24
2.18.2 Starting echo trails..2-25
2.18.3 Trail gradation..2-25
2.18.4 Echo trail mode..2-26
2.19 Echo Stretch..2-27
2.20 Echo Averaging..2-28
2.21 Outputting TLL Data..2-29
2.22 Guard Alarm..2-30
2.22.1 Setting a guard alarm zone..2-30
2.22.2 When the alarm is violated…..2-31
2.22.3 Cancelling the guard alarm..2-31
2.23 Watchman..2-32
2.23.1 How watchman works..2-32
2.23.2 Turning on/off watchman..2-32
2.23.3 Setting watchman stand-by interval..2-32
2.24 Suppressing Second-trace Echoes..2-33
2.25 Waypoint Marker..2-34
2.26 ARP, TTM Operation..2-35
2.26.1 Activating/deactivating ARP, TTM..2-36
2.26.2 Acquiring and tracking targets (ARP)..2-37

2.26.3 Displaying target number (ARP, TTM) 2-38
2.26.4 Terminating tracking of ARP targets 2-39
2.26.5 Setting vector attributes (ARP) 2-40
2.26.6 Displaying past position (ARP) 2-41
2.26.7 ARP, TTM target data 2-42
2.26.8 CPA/TCPA alarm (ARP) 2-43
2.26.9 Lost target alarm (ARP) 2-44
2.27 Interpreting the Radar Display 2-45
2.27.1 General 2-45
2.27.2 False echoes 2-47
2.27.3 SART (Search and Rescue Transponder) 2-49
2.27.4 Racon (Radar Beacon) 2-51

3. PLOTTER OPERATION 3-1
3.1 Plotter Displays 3-1
3.1.1 Full-screen plotter display 3-1
3.1.2 Compass display 3-3
3.1.3 Highway display 3-5
3.1.4 Nav data display 3-6
3.2 Presentation Mode 3-7
3.2.1 North-up 3-7
3.2.2 Course-up 3-8
3.2.3 Auto course-up 3-8
3.3 Shifting the Display 3-9
3.4 Chart Scale 3-9
3.5 Chart Cards 3-10
3.5.1 Chart card overview 3-10
3.5.2 Indices and chart enlargement 3-10
3.5.3 FURUNO and NavCharts™ charts 3-11
3.5.4 C-MAP charts 3-14
3.6 Working with Track 3-18
3.6.1 Displaying track 3-18
3.6.2 Stopping, restarting plotting of own ship track 3-19
3.6.3 Track plotting method and interval for own ship track 3-20
3.6.4 Changing own ship track/mark distribution setting 3-21
3.6.5 Erasing track 3-22
3.7 Marks, Lines 3-24
3.7.1 Entering a mark, line 3-24
3.7.2 Changing mark attributes 3-24
3.7.3 Selecting line type 3-25
3.7.4 Erasing marks, lines 3-26
3.8 Waypoints 3-28
3.8.1 Entering waypoints 3-28
3.8.2 Editing waypoint data 3-31
3.8.3 Erasing waypoints 3-33
3.8.4 Changing waypoint mark size (FURUNO, NavCharts™) 3-34
3.8.5 Searching waypoints 3-35

3.9 Routes 3-36
3.9.1 Creating routes 3-36
3.9.2 Connecting routes 3-40
3.9.3 Inserting a waypoint in a route 3-41
3.9.4 Removing waypoints from a route 3-43
3.9.5 Erasing routes 3-43
3.10 Navigation 3-44
3.10.1 Navigating to a “quick point” 3-44
3.10.2 Navigating to waypoints 3-45
3.10.3 Navigating to ports, port services (NavCharts™ only) 3-46
3.10.4 Following a route 3-48
3.10.5 Cancelling route navigation 3-51
3.11 Alarms 3-52
3.11.1 Audio alarm on/off 3-52
3.11.2 Arrival alarm 3-53
3.11.3 Anchor watch alarm 3-54
3.11.4 XTE (Cross-Track Error) alarm 3-55
3.11.5 Speed alarm 3-55
3.11.6 Proximity alarm 3-56
3.11.7 Trip alarm 3-57
3.11.8 Alarm information 3-58
3.12 Resetting Trip Distance 3-60

4. VIDEO SOUNDER OPERATION 4-1
4.1 Principle of Operation 4-1
4.2 Sounder Displays 4-2
4.2.1 Selecting a sounder display 4-2
4.2.2 Description of sounder displays 4-3
4.2.3 Selecting screen split method in combination displays 4-7
4.3 Automatic Sounder Operation 4-8
4.3.1 How the automatic sounder works 4-8
4.3.2 Types of automatic sounder modes 4-8
4.3.3 How to enable automatic sounder operation 4-8
4.4 Manual Sounder Operation 4-9
4.4.1 Selecting the manual mode 4-9
4.4.2 Selecting display range 4-9
4.4.3 Adjusting the gain 4-9
4.4.4 Shifting the range 4-10
4.5 Measuring Depth, Time 4-11
4.6 Reducing Interference 4-12
4.7 Reducing Low Level Noise 4-13
4.8 Erasing Weak Echoes 4-14
4.9 Picture Advance Speed 4-15
4.9.1 Advancement independent of ship’s speed 4-15
4.9.2 Advancement synchronized with ship’s speed 4-16
4.10 Alarms 4-17
4.10.1 Audio alarm on/off 4-17
4.10.2 Bottom alarm 4-18

4.10.3 Fish alarm....4-18
4.10.4 Fish alarm (B/L)....4-19
4.10.5 Water temperature alarm....4-20
4.10.6 When an alarm setting is violated....4-21
4.11 Water Temperature Graph....4-22
4.12 Interpreting the Sounder Display....4-23
4.12.1 Zero line....4-23
4.12.2 Bottom echo....4-23
4.12.3 Fish school echoes....4-24
4.12.4 Surface noise/Aeration....4-24

5. CUSTOMIZING YOUR UNIT....5-1
5.1 General Setup....5-1
5.2 Radar Setup....5-3
5.2.1 Radar display setup....5-3
5.2.2 Radar range setup....5-5
5.2.3 Function key setup....5-6
5.3 Plotter Setup....5-8
5.3.1 Navigation options....5-8
5.3.2 Function key setup....5-9
5.4 Chart Setup....5-11
5.4.1 Chart offset....5-11
5.4.2 FURUNO, NavCharts™ chart attributes....5-12
5.4.3 C-MAP chart attributes....5-13
5.5 Data Boxes Setup....5-16
5.6 Hot Page Setup....5-17
5.7 Navigator Setup....5-19
5.7.1 Navigation data source....5-19
5.7.2 GPS receiver setup....5-20
5.7.3 TD display setup....5-23
5.8 Nav Data Display Setup....5-25
5.9 Sounder Setup....5-26
5.9.1 System setup....5-26
5.9.2 Sensor setup....5-28
5.9.3 Sounding range, zoom range, bottom lock range....5-29
5.9.4 Function key setup....5-30

6. DATA TRANSFER....6-1
6.1 Memory Card Operations....6-1
6.1.1 Formatting memory cards....6-1
6.1.2 Saving data to a memory card....6-2
6.1.3 Playing back data from a memory card....6-4
6.2 Uploading, Downloading Data....6-5
6.2.1 Setting communication software on the PC....6-5
6.2.2 Uploading or downloading data....6-5
6.3 Loading Waypoint Data from Yeoman....6-8
6.4 Receiving Data Via Network Equipment....6-9
6.5 Outputting Data Through the Network....6-10

7. MAINTENANCE, TROUBLESHOOTING 7-1
7.1 Preventive Maintenance 7-1
7.2 Replacement of Battery 7-1
7.3 Replacement of Fuse 7-2
7.4 Trackball Maintenance 7-2
7.5 Simple Troubleshooting 7-3
7.5.1 General 7-3
7.5.2 Radar 7-3
7.5.3 Plotter 7-4
7.5.4 Sounder 7-5
7.6 Diagnostics 7-6
7.6.1 Memory I/O test 7-6
7.6.2 Test pattern 7-9
7.6.3 Keyboard, remote controller test 7-10
7.7 GPS Status Display 7-11
7.8 Clearing Memories 7-12
7.9 Error Messages 7-13

APPENDIX A-1
Menu Overview A-1
Geodetic Chart List A-10
World Time Chart A-11
Icons A-12

INDEX Index-1

SPECIFICATIONS SP-1

Declaration of Conformity

FOREWORD

A Word to the Owner of the Model 1833/1933/1943 Marine Radar

FURUNO Electric Company thanks you for purchasing the Model 1833/1933/1943 Marine Radar. We are confident you will discover why the FURUNO name has become synonymous with quality and reliability.

For over 50 years FURUNO Electric Company has enjoyed an enviable reputation for quality and reliability throughout the world. This dedication to excellence is furthered by our extensive global network of agents and dealers.

Your equipment is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly installed and maintained. Please carefully read and follow the operation and maintenance procedures set forth in this manual.

We would appreciate feedback from you, the end-user, about whether we are achieving our purposes.

Thank you for considering and purchasing FURUNO.

The example screens shown in this manual may not match the screens you see on your display. The screen you see depends on your system configuration and equipment settings.

Features

The Model 1833/1933/1943 Marine Radar series work within our new product-network system called the "NavNet." Each product has an IP address to communicate with NavNet compatible products within the network, using TCP/IP protocol through an Ethernet 10BASE-T network.

The main features are as follows:

- The 1833/1933/1943 series consists of the following models:

Model	Output	Range	Radar Antenna
1833	4 kW	36 nm	2 ft Radome
1933	4 kW	48 nm	3.5 ft Open
1943	6 kW	64 nm	4 ft Open

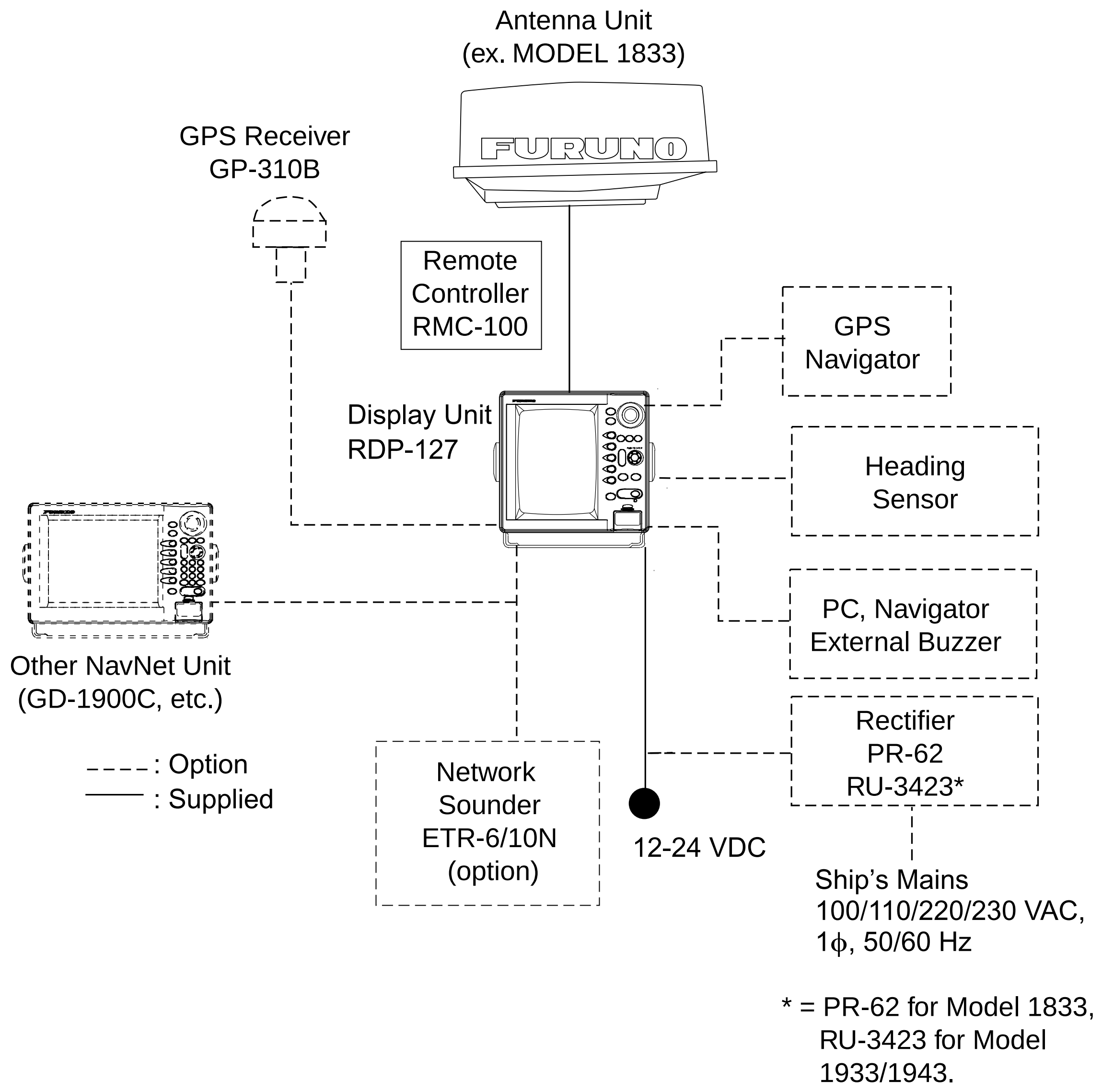
- Bright 10" screen visible even under direct sunlight.
- User-friendly operation with combination of discrete keys, soft keys, and trackball.
- Accepts FURUNO and NavCharts™ (NAVIONICS) charts, or C-MAP charts, depending on specification.
- Fast chart redraw.
- Built-in NavNet interface circuit board.
- 12-channel GPS Receiver GP-310B with highly accurate position fixing optionally available.
- User programmable function keys.
- Video sounder picture available with connection of the optional Network Sounder ETR-6/10N.

SYSTEM CONFIGURATIONS

All NavNet products incorporate a “network circuit board” to integrate each NavNet product on board through an optional LAN cable (Ethernet 10BASE-T). Each NavNet product is assigned an IP address to enable transfer of images between other NavNet products. For example, video plotter pictures can be transferred to a radar and vice versa. Pictures received via the NavNet may be adjusted at the receiving end.

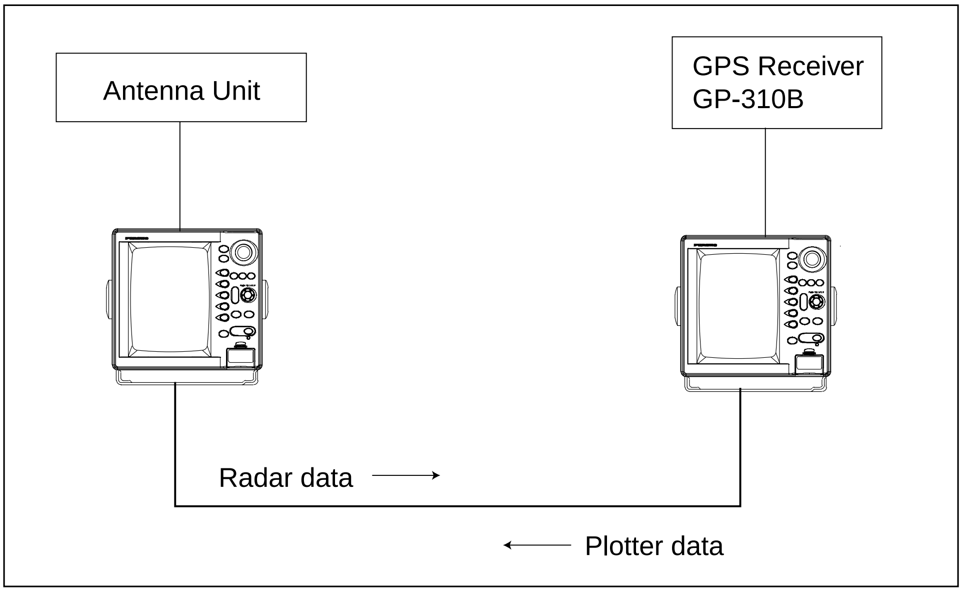
A NavNet system may consist of up to four NavNet display units and one network sounder. For a system incorporating three or more products, a “hub” is required to process data.

Single-unit NavNet system



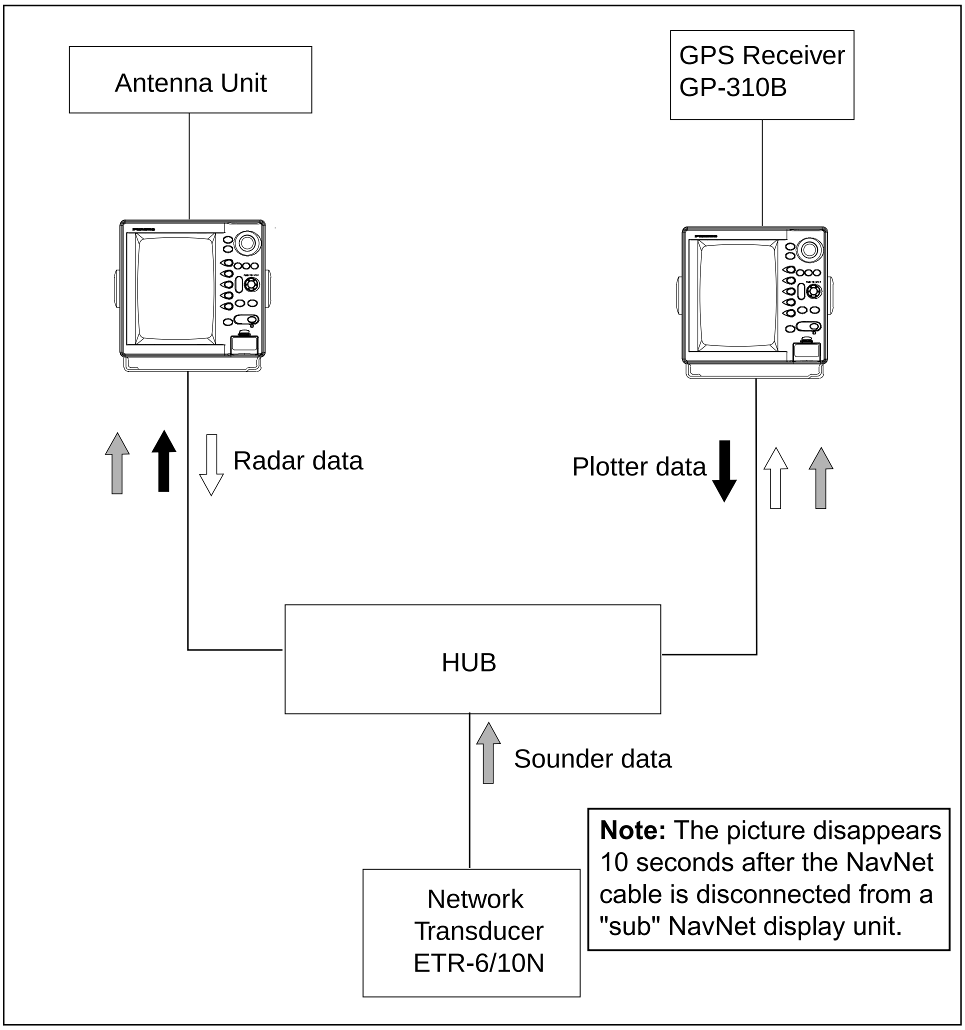
Single-unit NavNet system

Two-unit NavNet system



Two-unit NavNet system

Three-or-more-unit NavNet system (Max. 4 NavNet capable display units)



Three-or-more-unit NavNet system

1. OPERATIONAL OVERVIEW

This chapter provides basic information needed to get you started using your radar, video plotter. The following topics are presented:

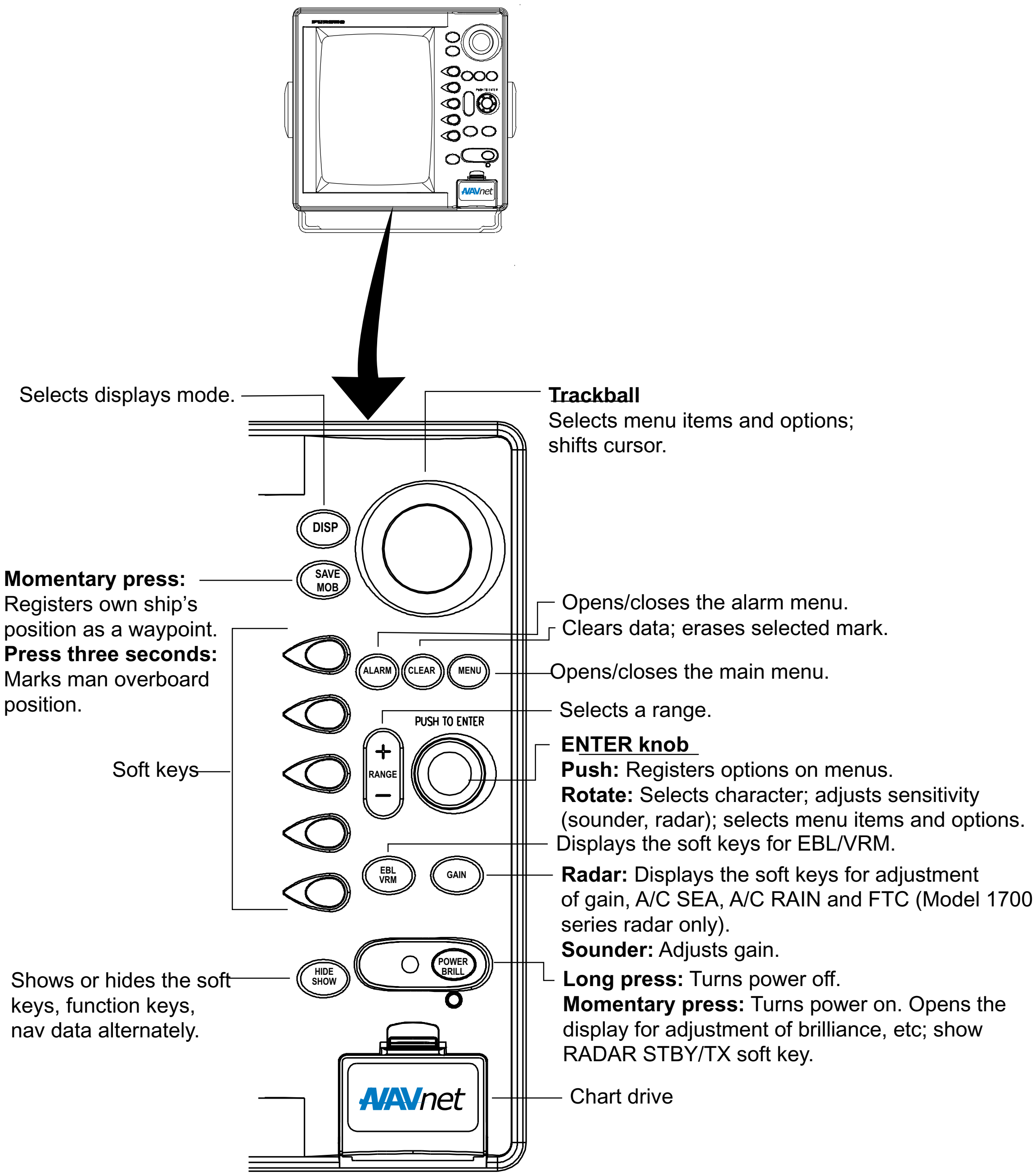
- Control overview
- Chart card insertion
- Power on/off
- Brilliance adjustments
- Display selection
- MOB (Man OverBoard) mark entry
- Data boxes
- Function keys
- Simulation display

1.1 Operating Controls

1.1.1 Display unit controls

Overview of display unit controls

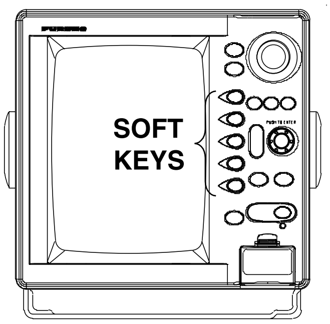
The radar, video plotter, sounder and chart systems are operated with the controls of the display unit (and the remote controller). Ten keys are labeled and they provide the function shown on their labels. The five soft keys provide various functions according to current operating mode. The [ENTER] knob mainly functions to register selections on the menu and adjust the EBL, VRM and gain. The trackball's main function is to move the cursor across the screen. When you correctly execute an operation, the unit generates a beep. Invalid operation causes the unit to emit three beeps.



Control panel

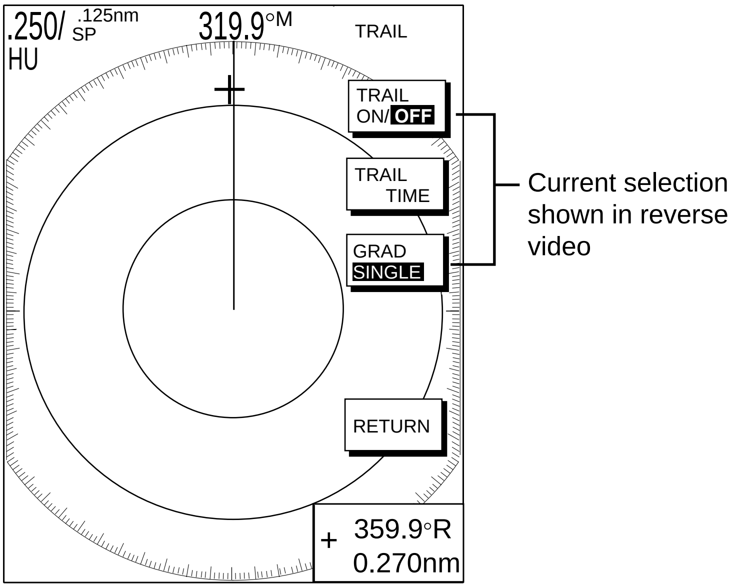
Soft keys

The function of the five soft keys changes according to the operation. Their labels for their current functions are shown on the screen to the left of the keys. To hide or show the soft keys, press the [HIDE/SHOW] key. Each press of the key shows preset soft keys, user function keys or turns off navigation information (in case of plotter mode).



Display unit

Some soft keys show the current state of the soft key function in reverse video as shown below.



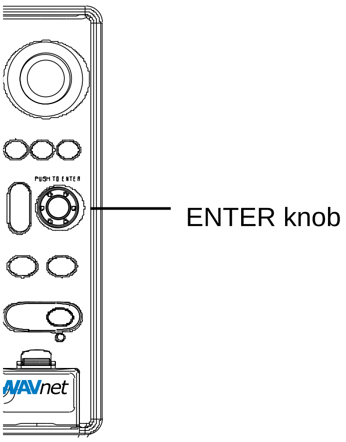
Radar display

[ENTER] knob

The [ENTER] knob functions to

- Register data
- Enter alphanumeric data such as waypoint name
- Select menu items and options
- Adjust setting

For data input, clockwise rotation of the knob selects an alphabet, symbol or numeric, in one of the sequences shown below. After you have selected desired alphanumeric character push the [ENTER] knob to register your selection.



ENTER knob

Alphabet, symbol, numeric

A⇆B⇆C⇆D⇆E⇆F⇆G⇆H⇆I⇆J⇆K⇆L⇆M⇆N⇆O⇆P⇆Q⇆R⇆S⇆T⇆U⇆V⇆W ⇆X⇆Y⇆Z⇆&⇆_⇆' ⇆#⇆0⇆1⇆2⇆3⇆4⇆5⇆6⇆7⇆8⇆9

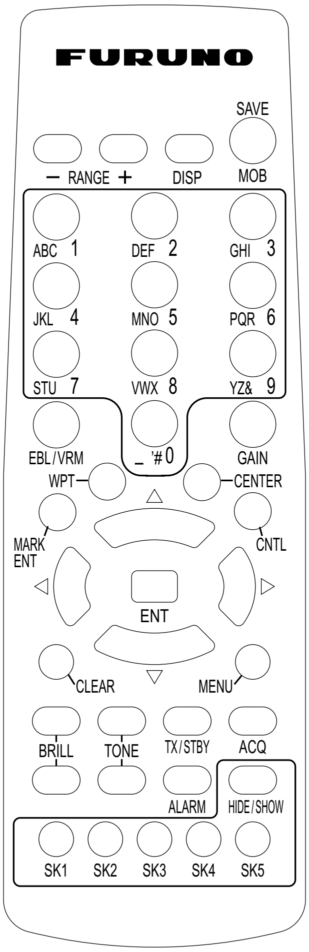
Numerics

0⇆1⇆2⇆3⇆4⇆5⇆6⇆7⇆8⇆9

Trackball

The trackball's main function is to shift the cursor. For details, see "paragraph 1.6."

1.1.2 Remote controller



<u>Operating distance</u>
90°: Up to 5 m
±45°: Up to 3 m

Replace the batteries (AA) when the distance from which the display unit can be operated shortens.

Note: The remote controller may become damaged if dropped. Mishandling of the remote controller is not covered by the warranty.

Remote controller

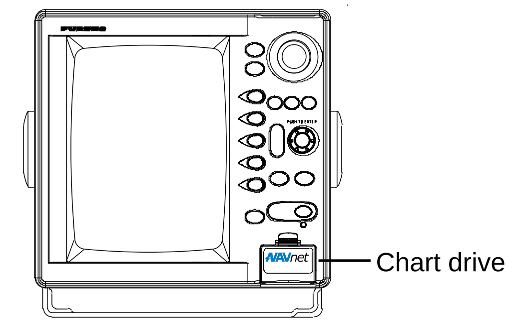
Key	Function	Key	Function
RANGE	Same as RANGE key on display unit.	ENT	Same as ENTER knob on display unit.
DISP	Same as DISP key on display unit.	CLEAR	Same as CLEAR key on display unit.
SAVE MOB	Same as SAVE/MOB key on display unit.	MENU	Same as MENU key on display unit.
Ten keys	Enter alphanumerics.	BRILL	Adjusts display brilliance.
EBL/VRM	Same as EBL/VRM key on display unit.	TONE	Not used.
GAIN	Same as GAIN key on display unit.	TX/STBY	Toggles radar between standby and transmit.
WPT	Displays “alphabet” WPT list on plotter display.	ACQ	Acquires radar target. (ARP-equipped set only).
MARK ENT	Same as MARK ENTRY soft key.	ALARM	Same as ALARM key on the display unit.
CENTER	Returns own ship to screen center on plotter display.	HIDE/SHOW	Same as HIDE/SHOW key on display unit.
CNTL	Switches control between displays on combination displays.	SK1 – SK5 (soft keys)	Same as soft keys on display unit.

.

1.2 Inserting a Chart Card

Your unit reads FURUNO and NavCharts™ (NAVIONICS) chart cards, or C-MAP chart cards, depending on the type of display unit you have. Insert the appropriate chart card for your area as follows:

1. Open the chart card drive.



Display unit

2. Insert desired chart card groove side up.
3. Close the lid to protect the chart drive.

Note 1: Do not remove a card while the chart is being drawn. This may cause the equipment to freeze.
Note 2: Do not insert or remove a card while the power is on. This may cause the equipment to freeze.
Note 3: For multiple display units, do not use the same chart card type in more than one display unit.
Note 4: A card remover is supplied to ease removal of chart cards. Attach the card remover to the right-hand side hole of the card and pull it to remove the card. You can leave the remover attached to the card while the card is in the chart drive. Push the remover leftward until it contacts the recessed area on the card.

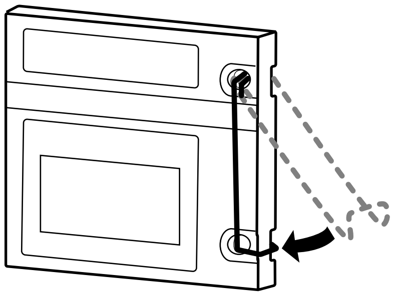
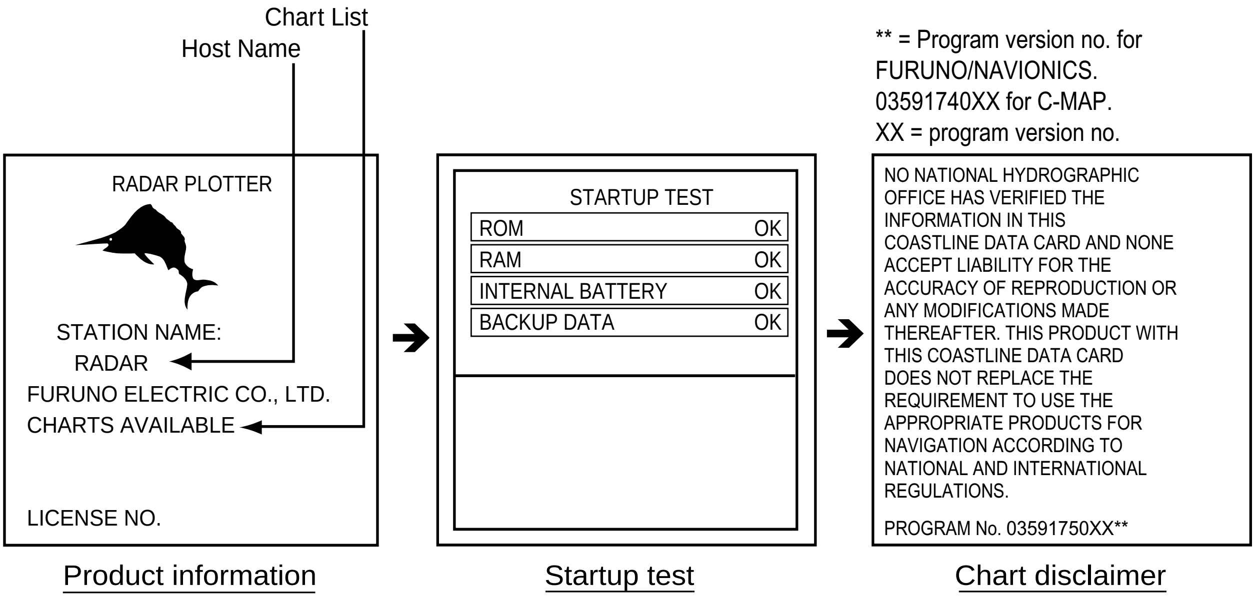


Chart card and card remover

1.3 Turning the Unit On/Off

Press the [POWER/BRILL] key to turn the unit on. A beep sounds and the equipment proceeds in the sequence shown below, displaying the product information screen, startup test results and the chart usage disclaimer. The startup test checks the ROM, RAM, internal battery and backup data for proper operation, displaying the results for each as OK or NG (No Good). If NG appears an appropriate message appears on the screen. For any NG, try to press any key to go to the chart disclaimer screen, then perform the diagnostic test referring to the paragraph "7.5 Diagnostics."



Startup sequence

The magnetron takes from one minute to two minutes and thirty seconds (depending on radar model) to warm up before the radar can be operated. The time remaining for warm up of the magnetron is counted down at the center of the display.

You may press any key at the chart disclaimer screen to show the last-used display, or wait several seconds to let the equipment do it for you.

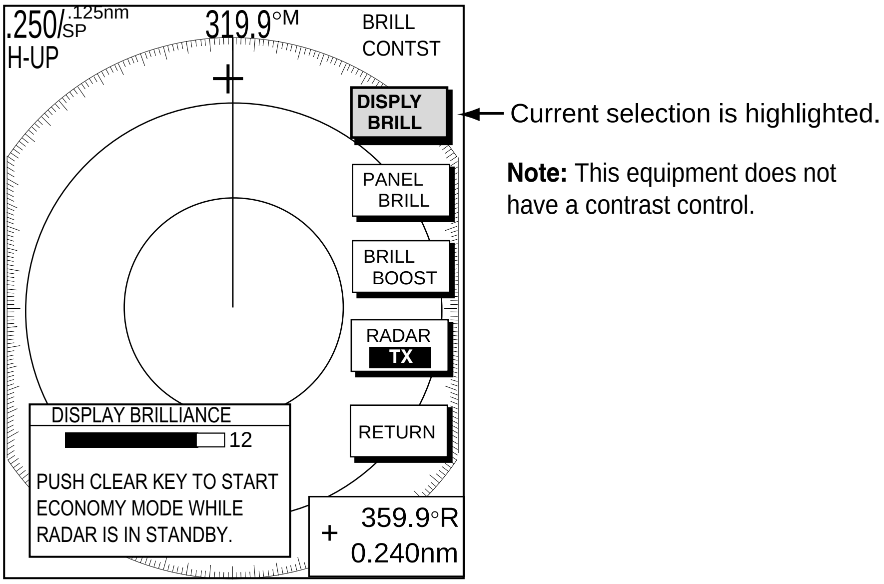
To turn the unit off, press and hold down the [POWER/BRILL] key until the screen goes dark (approx. 3 sec.). To protect the LCD attach the hard cover. Note that the network sounder will be turned off approx. three minutes after turning off the power.

Note: The first time you turn on the power (or any time the power is applied after a memory reset), you are asked if you want to start the simulation mode, which provides simulated operation of the equipment. Push the [ENTER] knob to start the simulation mode, or press the [CLEAR] key to start normal operation. For further details about the simulation mode, see the paragraph "1.10 Simulation Display."

1.4 Display Brilliance, Panel Brilliance, Brilliance Boost, Economy Mode

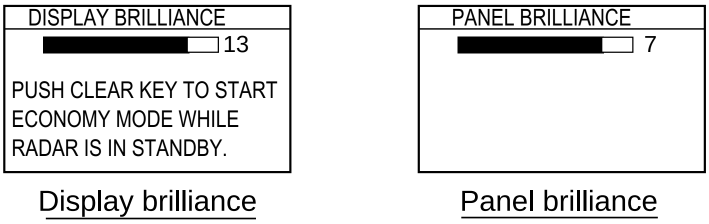
1.4.1 Display brilliance, panel brilliance

1. Press the [POWER/BRILL] key momentarily. A set of soft keys for adjustment of brilliance appear.



Brilliance adjustment soft keys

2. Press the DISPLY BRILL or PANEL BRILL soft key as appropriate. An adjustment window appears at the bottom of the screen. This window shows the name of the item selected for adjustment plus current brilliance level, by bar graph.



Display brilliance and panel brilliance windows

3. Adjust the [ENTER] knob, clockwise to raise the setting or counterclockwise to decrease it. You may also use the soft key pressed at step 2. Fifteen levels of display brilliance and eight levels of panel brilliance are available.
4. Hit the RETURN soft key to finish.

Note: If the equipment is turned off with minimum brilliance, press the [POWER BRILL] key consecutively to adjust the brilliance.

1.4.2 Brilliance boost

The brilliance boost feature provides increased brilliance for 5 minutes (default setting), after which the previous brilliance level is restored. You can set the amount of time among 3, 5, 10 and 15 minutes, on page 2 of the GENERAL SETUP menu. For further details see “Video Boost Time” on page 5-3.

1. Press the [POWER/BRILL] key momentarily.
2. Press the BRILL BOOST soft key.
3. Hit the RETURN soft key to finish.

To cancel the brilliance boost feature, press the DISPLAY BRILL soft key to adjust brilliance.

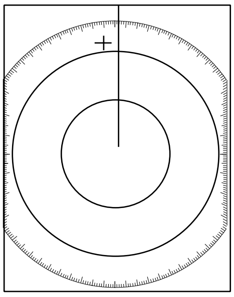
1.4.3 Economy mode

The economy mode shuts off the power to the CRT, which helps extend the life of the CRT. To turn on the economy mode, press the [POWER/BRILL] key momentarily (in the STBY mode for radar) to show the brilliance adjustment soft keys, then press the [CLEAR] key. To escape from the economy mode, press any key.

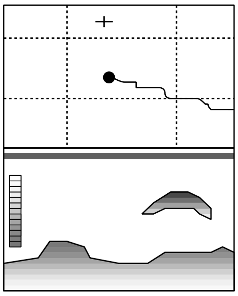
1.5 Selecting a Display

1.5.1 Display modes

If you have a radar, navigator and network sounder, four full-screen displays are available: radar, plotter, echo sounder, and navigation data. In addition to the full-screen display, you can divide the screen into halves to show two sets of images on a combination display.



Full screen
(Ex. radar)



Combination screen
(Ex. plotter + sounder)

Display screens

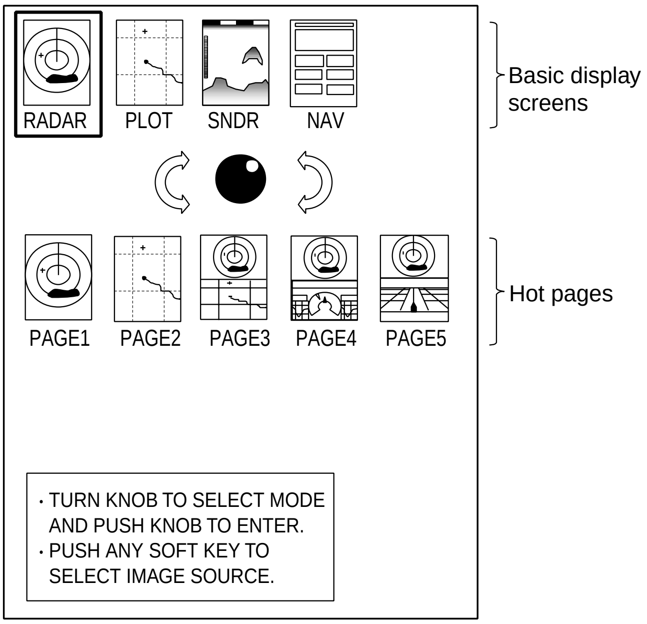
The table below shows the displays available with each screen type.

Screen type and available display screen

Full screen	Combination screen options
Plotter, radar, sounder, nav data	Plotter, radar, sounder, compass, highway, compass/highway, nav data

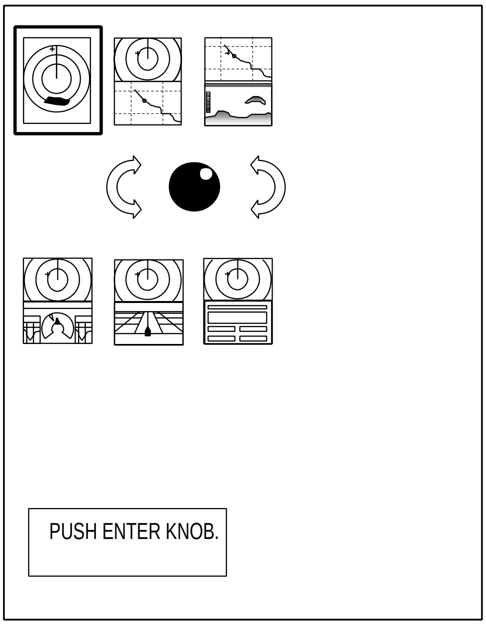
1.5.2 Selecting a display

1. Press the [DISP] key to show the display selection window. The icons of modes not available are marked with an “X.” PAGE1-PAGE5 are user-arrangeable displays called “hot pages,” which can you configure as you like. For further details, see the paragraph “5.6 Hot Page Setup.”



Display screen selection window

2. Rotate the [ENTER] knob to select a basic display screen or a hot page screen.
3. If you selected a basic display screen, a group of appropriate combination displays appear. Below are the combination screens available with the radar display.

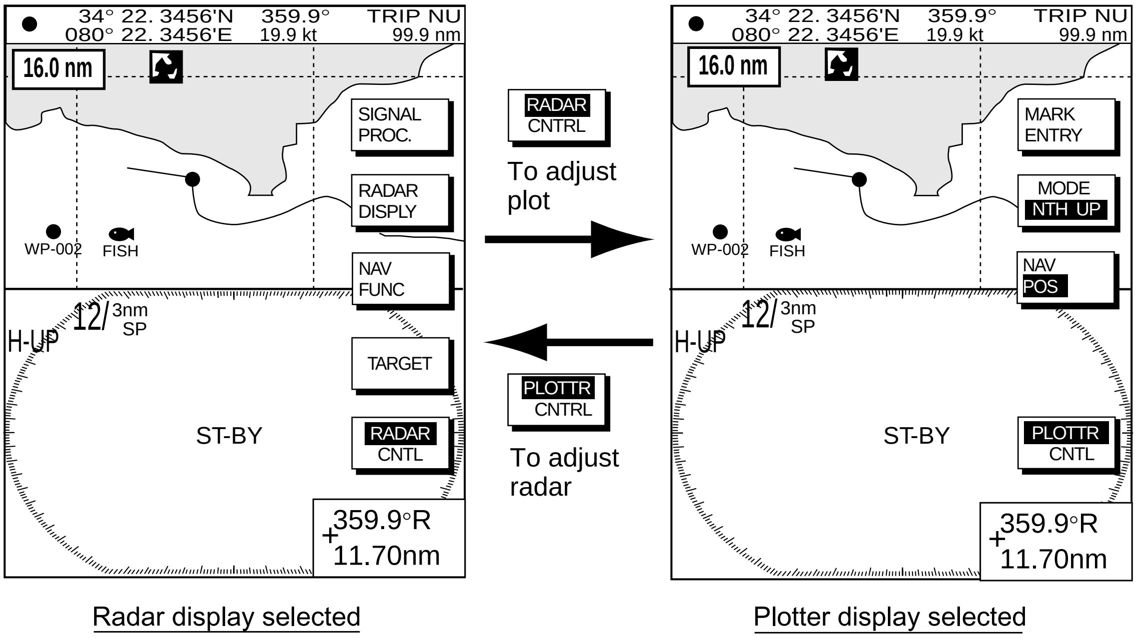


Radar combination screen selection window.

4. Rotate the [ENTER] knob to select display desired.
5. Push the [ENTER] knob to finish.

1.5.3 Switching control in combination screens

A soft key is provided in relevant combination screens to switch control between displays. In the example below, the RADAR CNTRL and PLOTTR CNTRL soft keys enable switching control between the radar and plotter screens in the plotter/radar combination display.

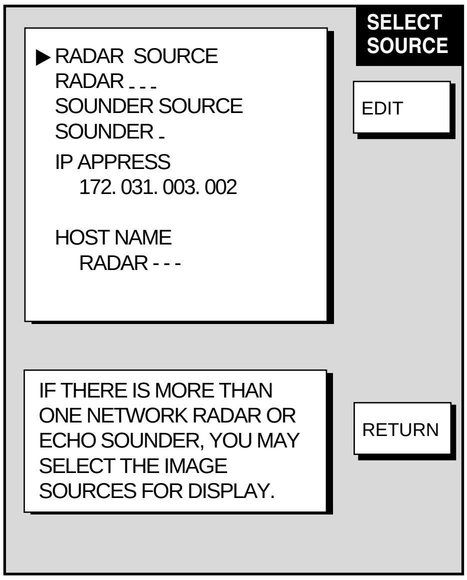


How to switch control between modes in the plotter/radar combination display

1.5.4 Selecting image source

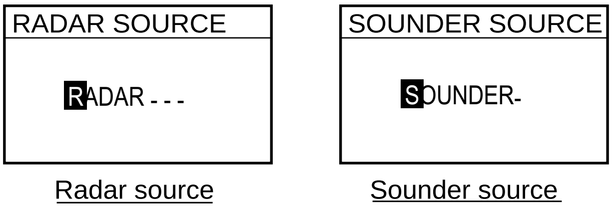
When more than one network radar or network sounder is connected to the equipment, you may select an image source for each as shown below. This is not necessary when only one network radar or network sounder is connected.

1. Press the [DISP] key.
2. Press any soft key to show the following display.



Select source menu

3. Use the trackball to select RADAR SOURCE or SOUNDER SOURCE as appropriate, then press the EDIT key.



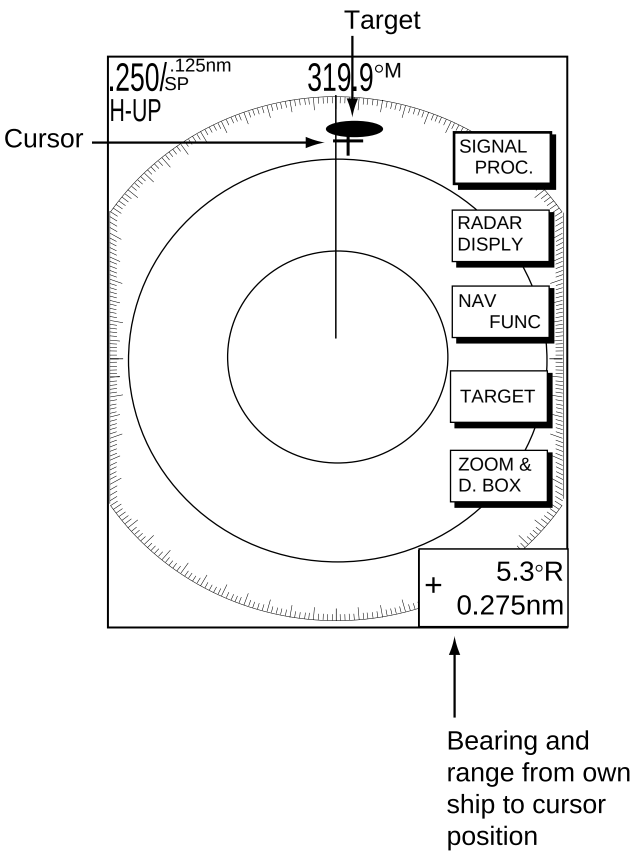
Radar source and sounder source windows

4. Adjust the trackball to select location and rotate the [ENTER] knob to set character.
5. Push the [ENTER] knob to set.
6. Press the [DISP] key to finish.
7. Turn the power off and on again.

Note: Source names are determined at installation. For example, the source names for radars in a two radar system might be "RADAR" and "RADAR1".

1.6 Trackball, Cursor

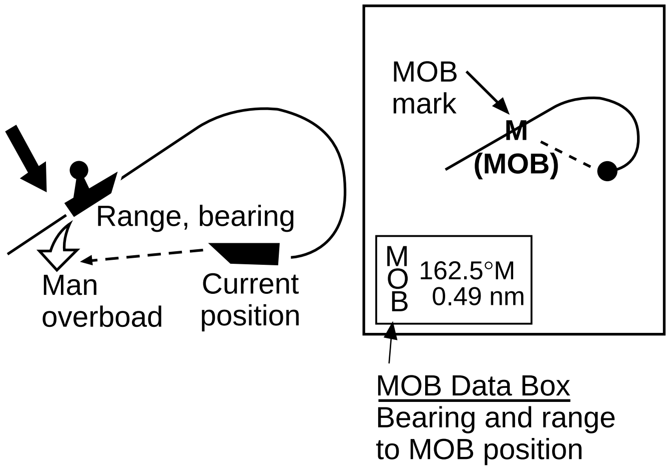
The trackball functions to shift the cursor, for measurement of range and bearing to a location. Roll the trackball to shift the cursor. The cursor moves in the direction of trackball rotation. Check the range and bearing indication at the bottom right-hand corner to see range and bearing from own ship to the cursor position.



Cursor, cursor data

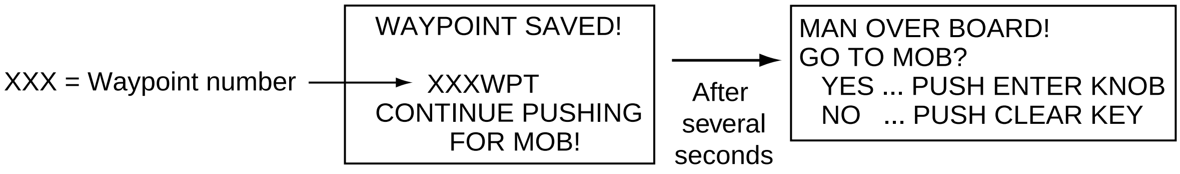
1.7 Entering the MOB Mark, Setting MOB as Destination

The MOB (Man Overboard) mark functions to mark man overboard position. You can inscribe this mark from any mode, except while playing back data or conducting any test. Note that this function requires position data.



MOB concept

1. Press and hold down the [SAVE/MOB] key for about three seconds when someone falls overboard. The display shows the waypoint number being saved (youngest empty waypoint number, 001-999) followed by the MOB confirmation window.



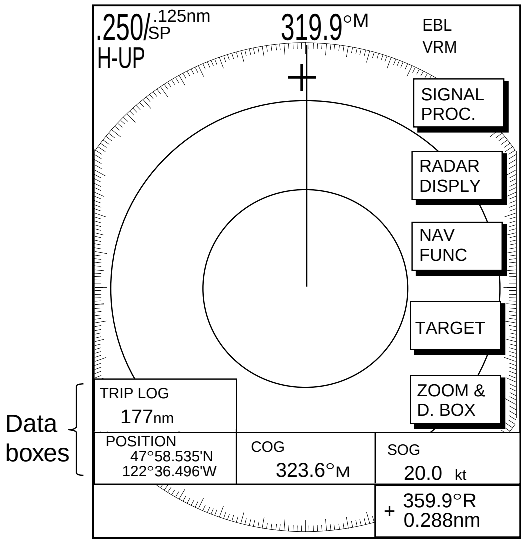
MOB mark messages

2. Push the [ENTER] knob to select the MOB position as destination, or press the [CLEAR] key to only mark current ship's position as a waypoint. If you select the MOB position as destination;
   - A full-screen radar or plotter screen appears depending on the display in use.
   - The MOB mark "MOB" appears at the MOB position and a line runs between it and current position. This line shows the shortest course to the MOB position.
   - Range and bearing to the MOB position are shown in the MOB data box.

To erase an MOB mark from the plotter display, you must first erase its corresponding waypoint. Place the cursor on the MOB mark, then press the [CLEAR] key followed by pushing the [ENTER] knob to erase the waypoint. Then, repeat to erase the MOB mark.

1.8 Data Boxes

Data boxes, providing navigation data, may be shown on any full-screen display. Up to six data boxes (two in case of large characters) may be shown, and the default data boxes are position (in latitude and longitude), course over ground, speed over ground and trip log. The user may choose which data to display, where to locate it, and show or hide it as desired. In addition, data boxes may be set independently for each display mode (plotter, radar, sounder). For how to select data for the data boxes, see the paragraph “5.5 Data Boxes Setup.”



Radar display, showing data boxes

1.8.1 Showing, hiding data boxes with soft key

Plotter: D. BOX ON/OFF
Radar: ZOOM & D. BOX → D. BOX ON/OFF (EBL/VRM data box, cursor data box also shown/hidden)
Sounder: AUTO/D. BOX→D. BOX ON/OFF

1.8.2 Rearranging data boxes

You may select the location for data boxes as follows:

1. Using the trackball, place the cursor inside the data box you wish to move. As the cursor enters the box it changes to a hand. Push the [ENTER] knob, and the hand changes to a fist, meaning the box is correctly selected.
2. Use the trackball to move the data box to the location desired, then push the [ENTER] knob.

1.8.3 Temporarily erasing a data box

If a data box is obscuring a desired object you may temporarily erase the box. Use the trackball to place the cursor inside the data box you wish to erase, then press the [CLEAR] key. To redisplay the box, press the D. BOX soft key twice to display it.

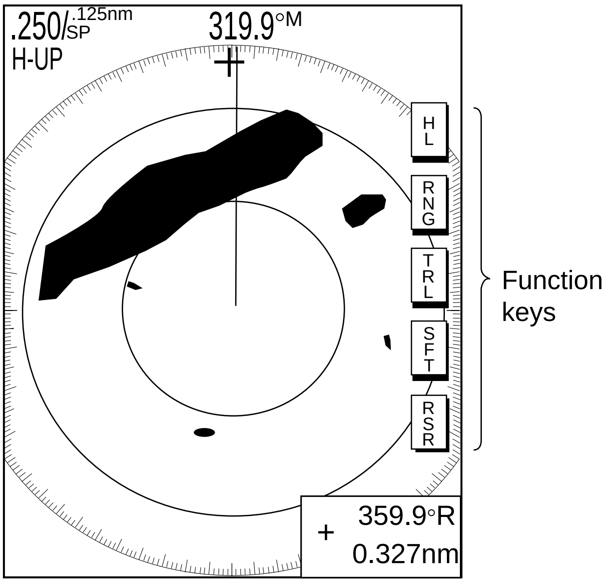
1.9 Function Keys

The function keys provide for one-touch execution of a desired function. The default function key settings for each display are as shown in the table below.

Function Key	Default Setting, Key Label		
	Radar	Plotter	Echosounder
#1	Heading line on/off, HL	Track on/off, TRK	TLL output, TLL
#2	Rings on/off, RNG	Edit mark/line, EML	Clutter, CLT
#3	Echo trail, TRL	Ruler, RUL	Signal level, SLV
#4	Offcenter, SFT	Add new waypoint, ADD	Noise limiter, NL
#5	Radar source, RSR	Waypoint alphanumeric list, ALP	Picture advance, PA

1.9.1 Executing a function

1. Press the [HIDE/SHOW] key to replace the preset soft key labels with the function key labels.



Function keys

2. Press function key desired.

Note: Function keys can be individually programmed for the plotter, radar and sounder displays. For further details see the following:

Radar: paragraph 5.2.3
Plotter: paragraph 5.3.2
Sounder: paragraph 5.9.4

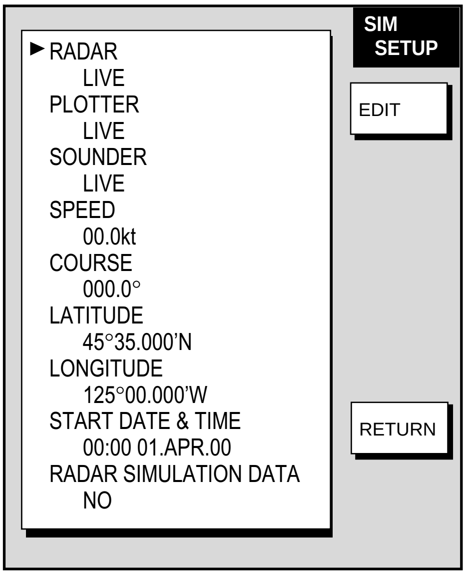
1.10 Simulation Display

The simulation display, for use by service technicians for demonstration purposes, provides simulated operation to help acquaint you with the many features your unit has to offer. It allows you to view and control a simulated plotter, radar and sounder picture, without position-fixing equipment, network radar or a network sounder. Most controls are operative, thus you may practice measuring the range and bearing to a target, etc.

The simulation icon (SIM) appears when a simulation mode is active.

To start the simulation display;

1. Press the [MENU] key.
2. Press the SYSTEM CONFIGURATION, SYSTEM SETUP and SIMULATION SETUP soft keys in that order.



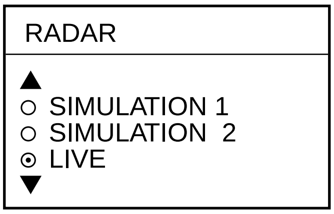
Simulation setup menu

3. Follow one of the procedures on the next several pages.

Radar

NavNet display unit-generated echoes

1. Select RADAR, then press the EDIT soft key.



2. Select SIMULATION 1, then push the [ENTER] knob.
3. Press the [MENU] key to close the menu.

NavNet radar antenna-generated echoes

1. Select RADAR SIMULATION DATA, then press the EDIT soft key.
2. Select YES, then push the [ENTER] knob to erase simulation data and get new data. The message “Now getting demo data. Do not turn off display unit.” appears while the unit is receiving radar data.

   Note: If the network radar could not be found “Radar source is not found. Cannot get demo data.” appears. And if the radar is not active, the message “Radar is not active. Cannot get demo data.” is displayed. Check that the radar is plugged in and that its signal cable is firmly fastened.

3. Select RADAR, then press the EDIT soft key.
4. Select SIMULATION 2, then push the [ENTER] knob.
5. Press the [MENU] key to close the menu.

Plotter

1. Select PLOTTER, then press the EDIT soft key.

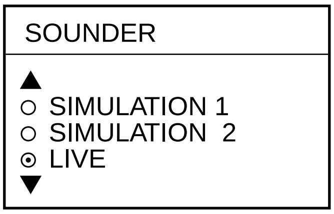
PLOTTER

▲
○ SIMULATION
⦿ LIVE
▼

2. Select SIMULATION, then push the [ENTER] knob.
3. Select SPEED, then press the EDIT soft key.
4. Enter speed (setting range, 0-99 kt, default speed, 0 kt) with the alphanumeric keys, then push the [ENTER] knob.
5. Select COURSE, then press the EDIT key.
6. Select “8 FIGURE” to trace the simulated ship’s track in a figure-eight course, or enter your own course at DIRECTION. To enter course, use the trackball to select location, then rotate the [ENTER] knob to select numeric.
7. Press the ENTER soft key.
8. Select LATITUDE, then press the EDIT soft key.
9. Enter latitude (setting range, 85°N-85°S, default setting, 45°35.000’N), then push the [ENTER] knob.
10. Select LONGITUDE, then press the EDIT soft key.
11. Enter longitude (setting range, 180°E-180°W, default setting, 125°00.000’W), then push the [ENTER] knob.
12. Select START DATE & TIME, then press the EDIT soft key.
13. Enter start date and time, then, push the [ENTER] knob.
14. Press the [MENU] key to close the menu.

<u>Sounder</u>

1. Select SOUNDER, then press the EDIT soft key.



2. Select SIMULATION 1 (internally generated echoes) or SIMULATION 2 (network sounder-generated echoes), then push the [ENTER] knob.

   Note 1: If the network sounder could not be found “Sounder source is not found. Cannot get simulation data.” appears. And if the sounder is not active, the message “Sounder is not active. Cannot get simulation data.” is displayed. Check that the sounder is plugged in and its signal cable is firmly fastened.

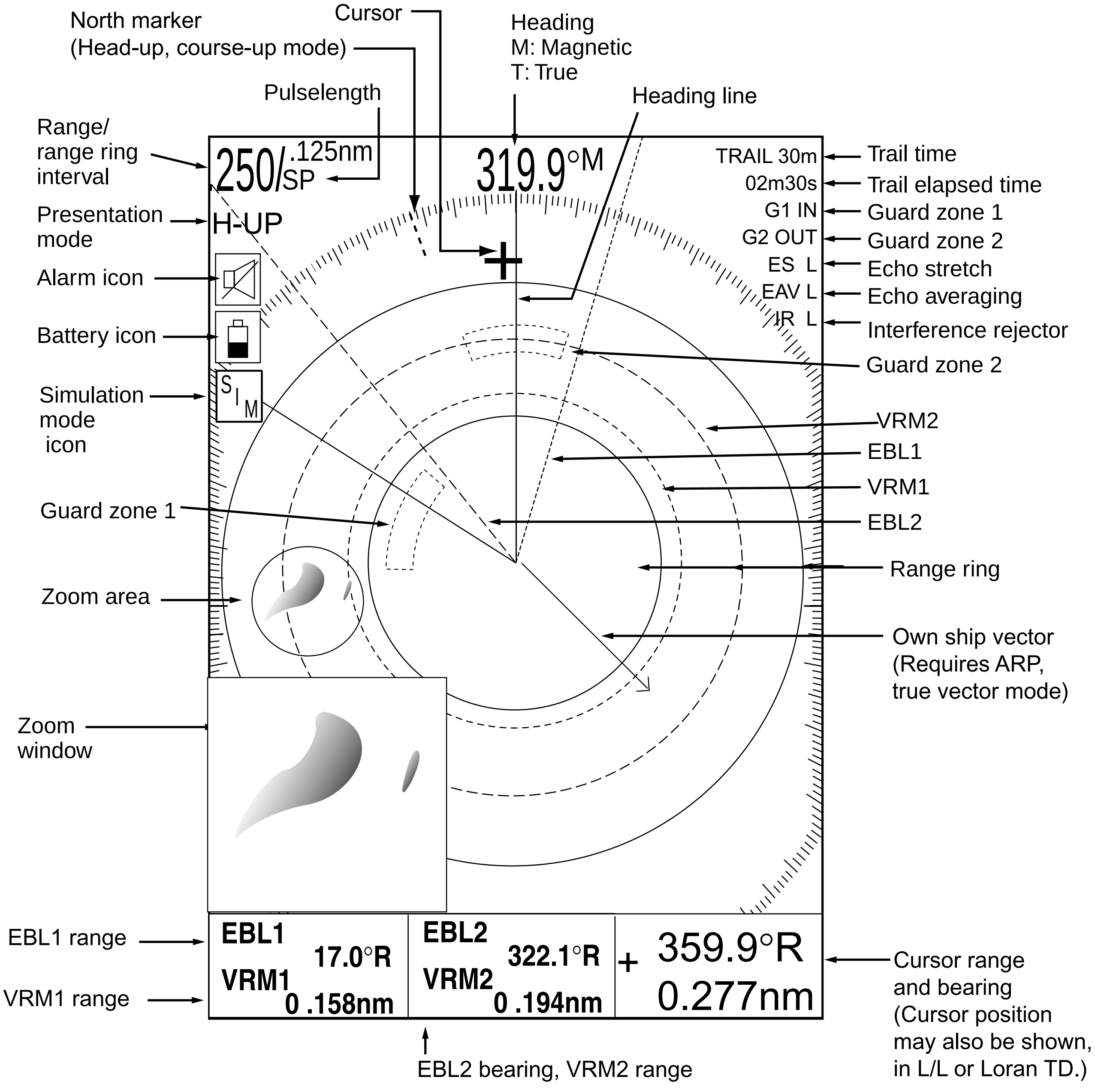
   Note 2: The gain, shift, range and mode of the SIMULATION 1 mode picture cannot be adjusted.

3. Press the [MENU] key to close the menu.

2. RADAR OPERATION

This chapter covers radar operation, including the ARP (Auto Plotter) function. ARP requires a Model 1800/1900 series network radar equipped with the ARP circuit board.

2.1 Radar Display



Radar display

2.2 Transmitting, Stand-by

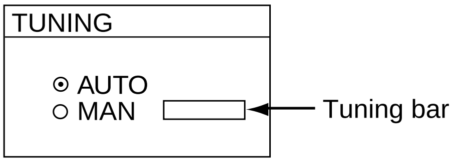
1. Confirm that the network radar is plugged in.
2. Press the [DISP] key to select a radar display.
3. Press the [POWER/BRILL] key momentarily.
4. Press the RADAR STBY soft key to highlight TX on its label.
5. Press the RETURN soft key.

When the radar picture is not required, but you want keep it in a state of readiness, press the RADAR TX soft key to highlight STBY on its label.

2.3 Tuning

The radar receiver can be tuned automatically or manually, and the default tuning method is automatic. If you require manual tuning, do the following:

1. Press the [MENU] key to display the main menu.
2. Press the RADAR DISPLAY SETUP soft key.
3. Select TUNING, then press the EDIT soft key.



Tuning window

4. Choose MAN.
5. Adjust the [ENTER] knob until the tuning bar is at its longest position.
6. Press the [MENU] key to close the menu.

Note: If the auto setting does not provide satisfactory tuning, ask your dealer how to re-adjust tuning.

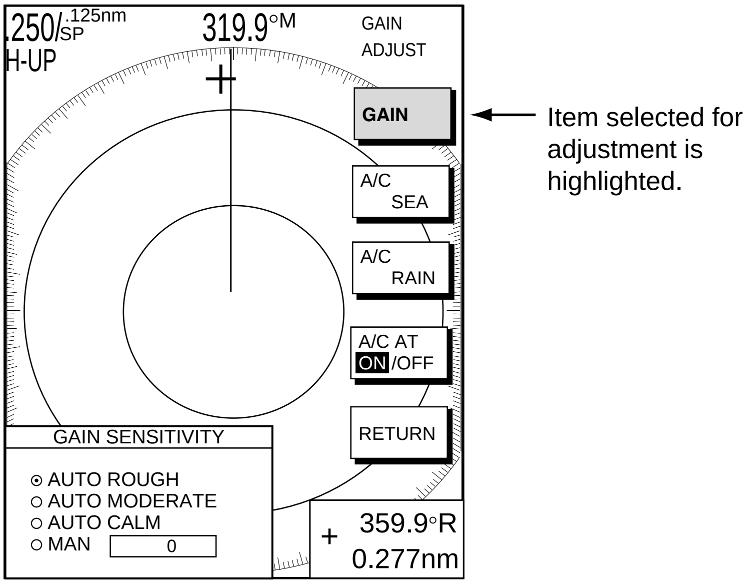
2.4 Adjusting the Gain

The [GAIN] key adjusts the sensitivity of the radar receiver. It works in a manner similar to the volume control of a broadcast receiver, which amplifies received signals.

The proper setting is such that the background noise is just visible on the screen. If your gain setting is too low, weak echoes may be missed. On the other hand, excessive gain yields too much background noise; strong targets may be missed because of the poor contrast between desired echoes and the background noise on the display.

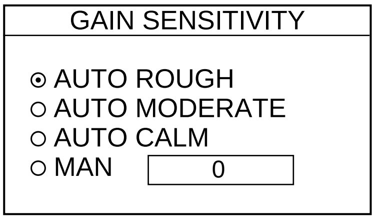
To adjust the receiver sensitivity, transmit on long range, and then do the following:

1. Press the [GAIN] key to show the “gain adjustment” soft keys. The last-used adjustment window appears. The example below shows the gain sensitivity adjustment window.



Gain adjustment soft keys

2. If the gain sensitivity window is not is not displayed, press the GAIN soft key to show it.



Gain sensitivity window

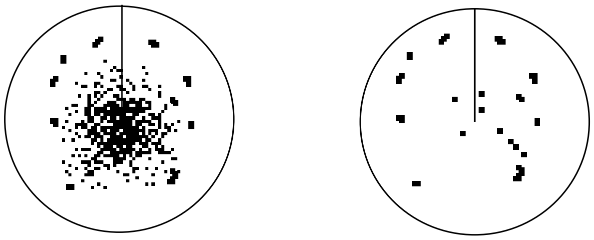
3. Use the trackball to select AUTO ROUGH, AUTO MODERATE, AUTO CALM, or MAN (manual) as appropriate. Select an AUTO option according to the sea state.
4. For manual adjustment, rotate the [ENTER] knob to adjust, observing the radar echo. The range of adjustment is 0-100(%).
5. Press the [GAIN] key on the front panel or the RETURN soft key to finish.

2.5 Reducing Sea Clutter

2.5.1 How the A/C SEA works

Echoes from waves can be troublesome, covering the central part of the display with random signals known as “sea clutter”. The higher the waves and the higher the antenna above the water, the further the clutter will extend. Sea clutter may affect radar performance because real targets are sometimes hidden by the echoes of small waves. (See the left-hand figure in the figure below.) When sea clutter masks the picture, adjust the A/C SEA to reduce the clutter.

The A/C SEA reduces the amplification of echoes at short ranges (where clutter is the greatest) and progressively increases amplification as the range increases, so amplification will be normal at those ranges where there is no sea clutter.



Sea clutter at screen center

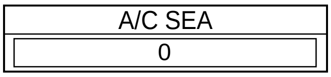
A/C SEA adjusted; sea clutter suppressed

Effect of A/C SEA

2.5.2 Adjusting the A/C SEA

A/C SEA should be adjusted so that the clutter is broken up into small dots, and small targets become distinguishable.

1. Press the [GAIN] key.
2. Press the A/C SEA soft key to show the A/C SEA setting window.



A/C SEA setting window

3. Rotate the [ENTER] knob to adjust. The range of adjustment is 0-100(%). Do not overadjust – weak targets may be missed.
4. A/C SEA and A/C RAIN can be automatically adjusted. Press the A/C AT ON/OFF soft key to select ON or OFF as appropriate. When turned on, it overrides A/C SEA and A/C RAIN settings.
5. Press the [GAIN] key on the front panel or RETURN soft key to finish.

2.6 Reducing Precipitation Clutter

The vertical beamwidth of the antenna is designed to see surface targets even when the ship is rolling. However, by this design the unit will also detect precipitation clutter (rain, snow, hail, etc.) in the same manner as normal targets. Precipitation clutter shows as random dots on the screen.

2.6.1 Adjusting the A/C RAIN

When echoes from precipitation mask solid targets, adjust the A/C RAIN to split up these unwanted echoes into a speckled pattern, making recognition of solid targets easier.

1. Press the [GAIN] key.
2. Press the A/C RAIN soft key to show the A/C RAIN window.

A/C RAIN
0

A/C RAIN setting window

3. Rotate the [ENTER] knob to adjust the A/C RAIN. The current level is shown on the A/C RAIN level bar in the A/C RAIN window, and the range of adjustment is 0 to 100(%). Do not overadjust – weak targets may be missed.
4. Press the [GAIN] key on the front panel or RETURN soft key to finish.

2.7 Range Scale

The range setting determines the size of the area (in nautical miles) that will appear on your display. In addition, the range setting will also automatically adjust the range ring interval so that accurate range measurements may be made while operating on any range setting.

The range, range ring interval and pulselength appear at the top left-hand corner of the display.

Press the [RANGE (+ or -)] key to change the range scale.

Range scales (nm, sm)

Range	0.125	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16	24	36	48	64
Ring Interval	0.0625	0.125	0.125	0.25	0.25	0.5	0.5	1	1	2	2	3	4	6	12	12	16
No. of Rings	2	2	4	3	4	3	4	3	4	3	4	4	4	4	3	4	4

Range scales (km)

Range	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16	24	36	48	64
Ring Interval	0.125	0.25	0.25	0.25	0.5	0.5	1	1	2	2	3	4	6	12	12	16
No. of Rings	2	2	3	4	3	4	3	4	3	4	4	4	4	3	4	4

Note 1: Maximum range depends on the network radar as shown below.

Model 1833: 36 nm
Model 1933: 48 nm
Model 1943: 64 nm

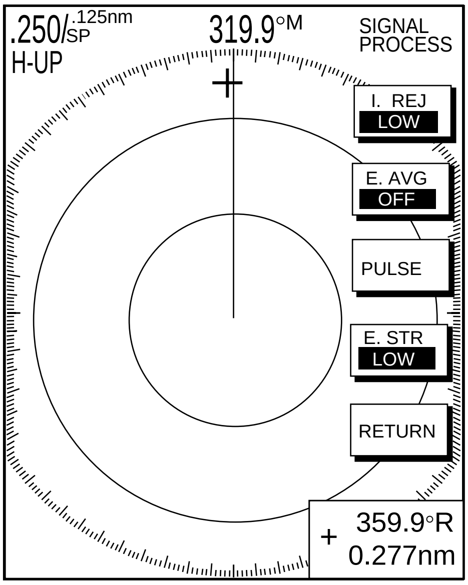
Note 2: You may choose which ranges to use from the RADAR RANGE SETUP menu. For details see paragraph 5.2.2.

2.8 Pulselength

The pulselength in use is displayed at the upper left corner of the display. Appropriate pulselengths are preset to individual range scales. Therefore, you are not usually required to select them. If you are not satisfied with the current pulselength setting, however, it is possible to change them for the ranges shown below. Generally, select a longer pulse for longer detection range and shorter pulse for better range discrimination.

1.5 nm, 1.5 sm, 3 km range: Short pulse, medium pulse
3 nm, 3 sm, 6km range: Medium pulse, long pulse

1. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
2. Press the SIGNAL PROC. soft key.



Signal process soft keys

3. Select the 1.5 nm (1.5 sm, 3 km) or 3 nm (3 sm, 6 km) range with the RANGE key.
4. Press the PULSE soft key to select the pulselength setting. SHORT or MEDIUM for 1.5 nm, 1.5 sm, 3 km and MEDIUM or LONG for 3 nm, 3 sm, 6 km.
5. Press the RETURN soft key to finish.

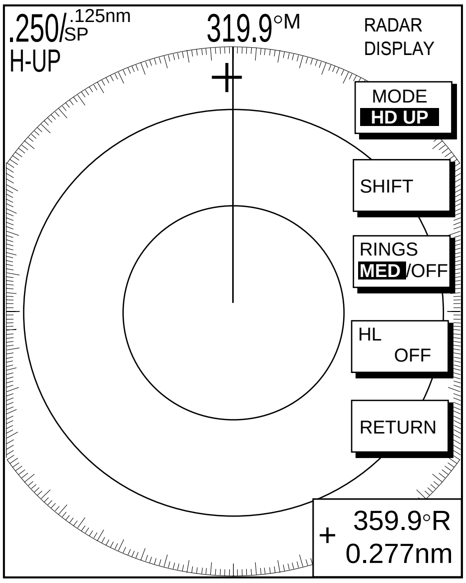
2.9 Presentation Mode

This unit provides four radar presentation modes: head-up, course-up, north-up and true motion.

Heading input is required for modes other than head-up.

2.9.1 Selecting a presentation mode

1. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
2. Press the RADAR DISPLY soft key to show the RADAR DISPLAY soft keys.



Radar display soft keys

3. Press the MODE soft key. Each pressing of the key changes the presentation mode and the presentation mode indication in the sequence of North-up, True Motion, Head-up, and Course-up.
4. Press the RETURN soft key to finish.

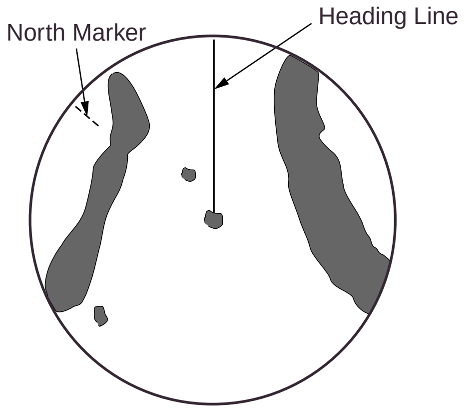
Note: When heading data is lost, the presentation mode automatically goes to head-up, the heading indication at the screen top shows "- - -.-°" and the audio alarm sounds. Press the [ALARM] key to acknowledge the alarm. The message "HEADING DATA MISSING" appears. Restore compass signal to show heading indication. Use the MODE soft key to select presentation mode if necessary. The audio alarm may be silenced with the [CLEAR] key.

2.9.2 Description of presentation modes

Head-up (HU)

A display without azimuth stabilization in which the line connecting the center with the top of the display indicates own ship's heading. The targets are painted at their measured distances and in their directions relative to own ship's heading.

A short line on the bearing scale is the north marker.

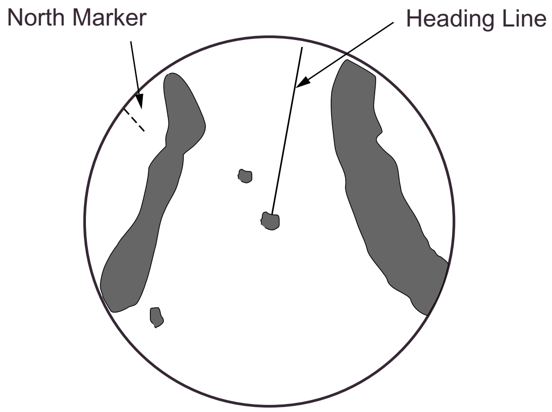


Head-up presentation mode

Course-up (CU)

The radar picture is stabilized and displayed with the currently selected course at the top of the screen. As you change heading, the ship's heading line moves. If you select a new course, the picture resets to display the new course at the top of the display.

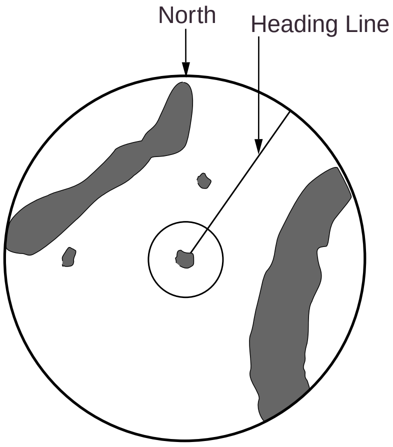
Targets are painted at their measured distances and in their directions relative to the intended course which is maintained at the 0-degree position. The heading line moves in accordance with ship's yawing and course changes.



Course-up presentation mode

North-up (NU)

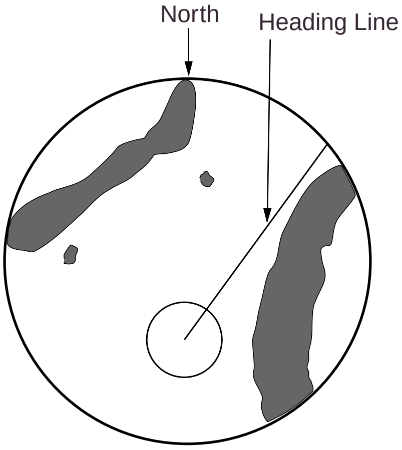
In the north-up mode, targets are painted at their measured distances and in their true (compass) directions from own ship. North is maintained at the top of the screen. The heading line changes its direction according to ship's heading.



North-up presentation mode

True motion (TM)

Fixed radar targets maintain a constant position on the screen, while your own ship moves across the radar image at the correct speed and heading. A map-like image is displayed, with all moving vessels traveling in true perspective to each other and to fixed landmasses. As your ship's position approaches the edge of the screen, the radar display is automatically reset to reveal the area ahead of your ship. You can manually reset your ship's position at any time by pressing the RADAR DISPLY soft key followed by the SHIFT soft key.



True motion presentation mode

2.10 Measuring the Range

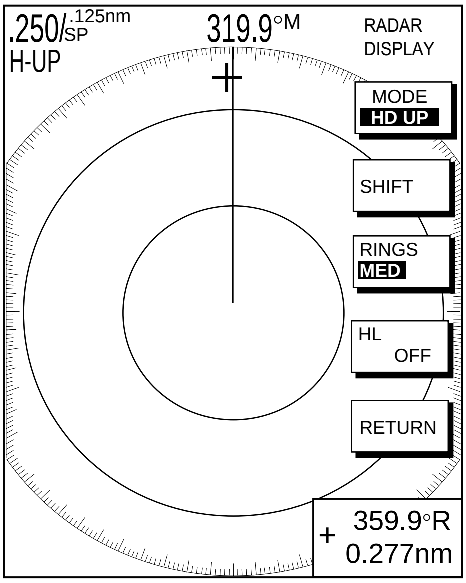
You can measure the range to a radar target three ways: by the range rings, by the cursor, and by the VRM (Variable Range Marker).

2.10.1 Measuring range by range rings

Count the number of rings between the center of the display and the target. Check the range ring interval and judge the distance of the echo from the inner edge of the nearest ring.

To turn the range rings on, do the following:

1. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
2. Press the RADAR DISPLY soft key.

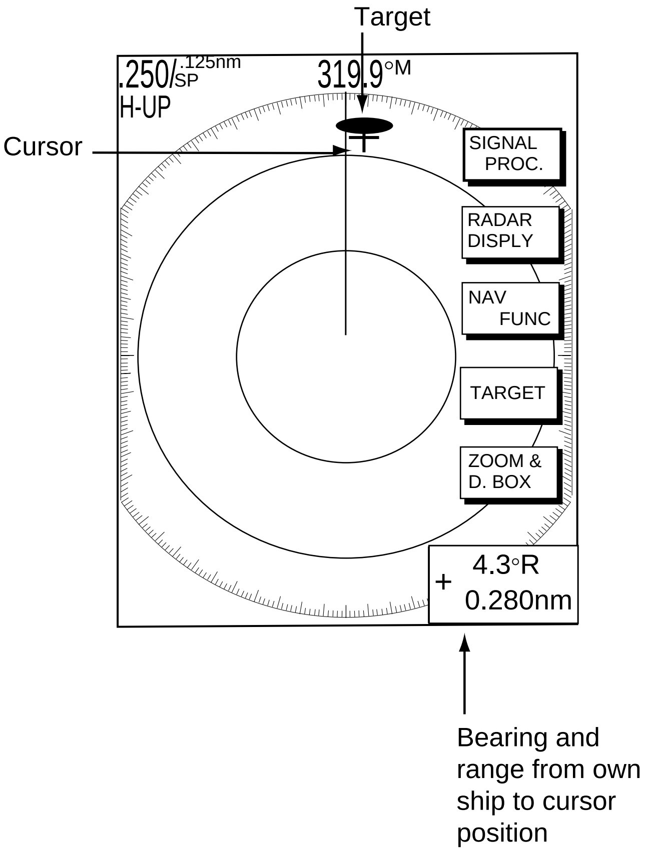


Radar display soft keys

3. Press the RINGS soft key to change the brilliance among LOW, MED, HIGH and OFF.
4. Press the RETURN soft key to finish.

2.10.2 Measuring range by cursor

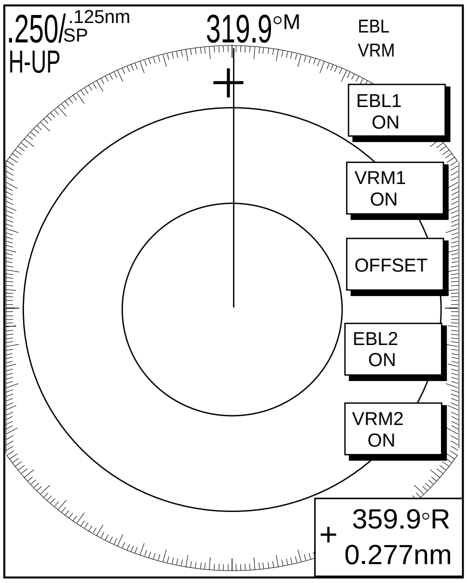
Operate the trackball to place the cursor intersection on the inside edge of the radar target. The range to the target, as well as the bearing, appears to the right of “+” at the bottom of the display.



How to measure range to a target with the cursor

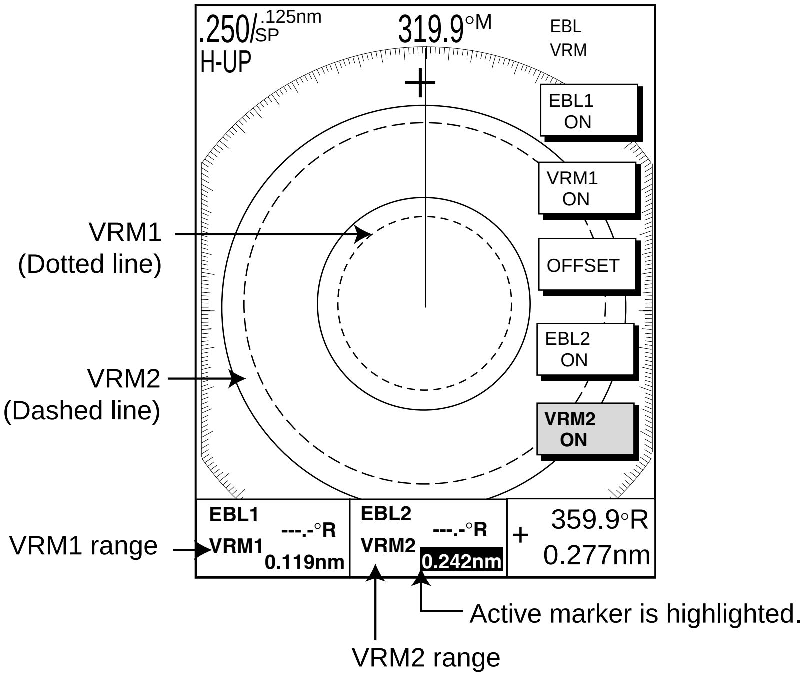
2.10.3 Measuring range by VRM

1. Press the [EBL/VRM] key to display the EBL/VRM soft keys.



EBL/VRM soft keys

2. Press the VRM1 ON (dotted ring VRM) or VRM2 ON (dashed ring VRM) soft key to select the desired VRM. The selected VRM's indication, at the bottom of the screen, is highlighted.
3. Rotate the [ENTER] knob the place the VRM on the inside edge of a radar target. Read the VRM indication to find range to the target.



How to measure range with the VRM

4. You may turn off the EBL/VRM soft keys by pressing the [EBL/VRM] key.

2.10.4 Erasing a VRM, VRM indication

Press appropriate VRM soft key, then press the [CLEAR] key. The VRM is erased and its indication becomes blank.

2.10.5 Erasing EBL/VRM data boxes

Press the EBL or VRM soft key associated with the EBL/VRM data box you wish to erase. Press the [CLEAR] key once or twice to erase the data box.

2.10.6 Hiding EBL/VRM data boxes

Press the ZOOM & D. BOX and D. BOX ON/OFF soft keys to show or hide the EBL/VRM data boxes.

2.10.7 Moving EBL/VRM data boxes

When an EBL/VRM data box is obscuring a target you want to see, you can move it to another location as shown below. This cannot be done when the EBL/VRM soft keys are shown.

2. Press the [EBL/VRM] key to erase the EBL/VRM soft keys.
3. Using the trackball, place the cursor inside the data box you wish to move. As the cursor enters the box it changes to a “hand.” Push the [ENTER] knob, and the hand changes to a fist, meaning the box is correctly selected.
3. Use the trackball to move the data box to the location desired, then push the [ENTER] knob.

2.11 Measuring the Bearing

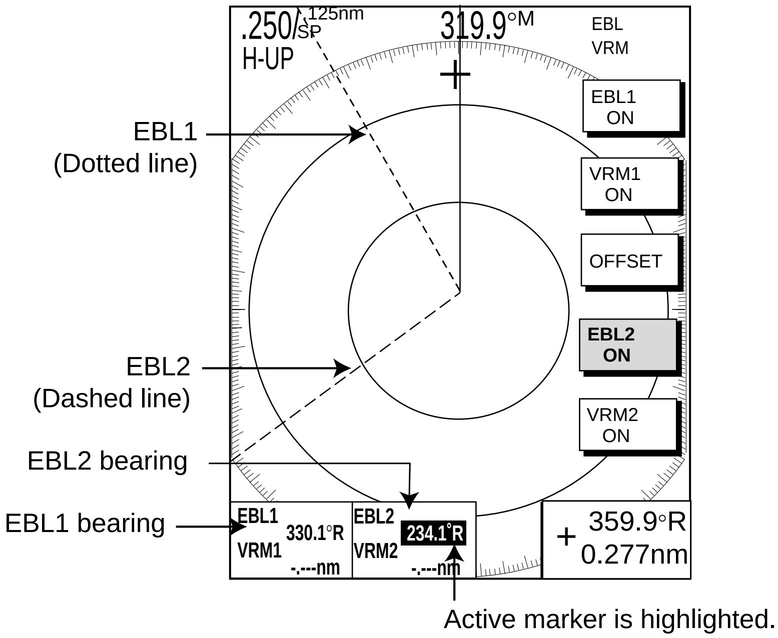
There are two ways to measure the bearing to a target: by the cursor, and by the EBL (Electronic bearing Line).

2.11.1 Measuring bearing by cursor

Use the trackball to place the cursor at the center of the target. The bearing to the target appears in the range and bearing box at the bottom right-hand corner on the screen.

2.11.2 Measuring bearing by EBL

1. Press the [EBL/VRM] key.
2. Press the EBL1 ON (dotted line EBL) or EBL2 ON (dashed line EBL) soft key to select the desired EBL. The selected EBL's indication, at the bottom of the screen, is highlighted.
3. Rotate the [ENTER] knob to bisect the radar target with the EBL. Read the EBL indication to find the bearing to the target.
4. You may erase the EBL/VRM soft keys by pressing the [EBL/VRM] key.



How to measure bearing with the EBL

Note: The bearing to a target may be shown relative to own ship's heading (Relative) or True bearing (requires heading data). This may be done with "EBL REFERENCE," which is in the RADAR DISPLAY SETUP menu.

2.11.3 Erasing an EBL, EBL indication

Press appropriate EBL soft key, then press the [CLEAR] key. The EBL is erased and its indication becomes blank.

2.11.4 Erasing EBL/VRM data boxes

Press the EBL or VRM soft key associated with the EBL/VRM data box you wish to erase. Press the [CLEAR] key once or twice to erase the data box.

2.11.5 Hiding EBL/VRM data boxes

Press the ZOOM & D. BOX and D. BOX ON/OFF soft keys to show or hide the EBL/VRM data boxes.

2.11.6 Moving EBL/VRM data boxes

When an EBL/VRM data box is obscuring a target you want to see, you can move it to another location as shown below. This cannot be done when the EBL/VRM soft keys are shown.

1. Press the [EBL/VRM] key to erase the EBL/VRM soft keys.
2. Using the trackball, place the cursor inside the data box you wish to move. As the cursor enters the box it changes to a “hand.” Push the [ENTER] knob, and the hand changes to a fist.
3. Use the trackball to move the data box to the location desired, then push the [ENTER] knob. Place the cursor in the data box, then push the [ENTER] knob.

2.12 Erasing the Heading Line, North Marker

The heading line indicates the ship's heading in all presentation modes. It is a line from the own ship position to the outer edge of the radar display area and appears at zero degrees on the bearing scale in head-up mode; it changes its orientation in the north-up, course-up and true motion modes with ship’s movement.

The north marker appears as a short dashed line. In the head-up and course-up modes the north marker moves around the bearing scale as the ship’s heading moves.

To temporarily erase the heading line and north marker, press the RADAR DISPLY soft key followed by the HL OFF soft key. Release the key to redisplay the markers. (If the radar soft keys are not shown, hit the [HIDE/SHOW] key to display them.)

2.13 Reducing Noise Interference

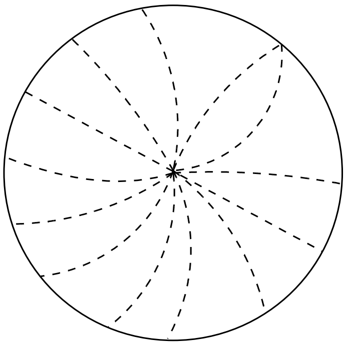
Noise, appearing on the displays as random “speckles,” can be reduced as follows:

1. Press the [MENU] key to open the menu.
2. Press the RADAR DISPLAY SETUP soft key.
3. Select NOISE REJECTION, then press the EDIT soft key.
4. Select OFF, LOW or HIGH as appropriate.
5. Press the ENTER soft key.
6. Press the [MENU] key to close the menu.

2.14 Rejecting Radar Interference

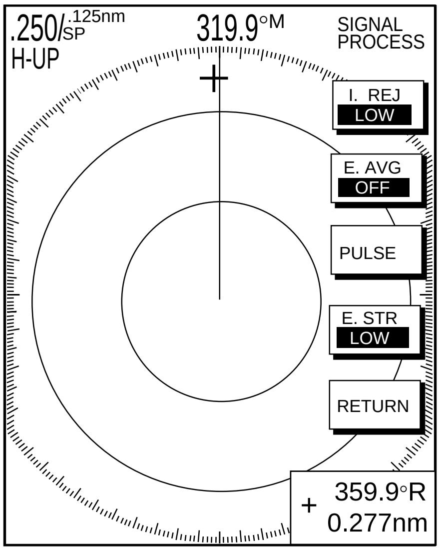
Radar interference may occur when near another shipborne radar that is operating in the same frequency band as your radar. Its on-screen appearance looks like many bright dots either scattered at random or in the form of dotted lines extending from the center to the edge of the display. Interference effects are distinguishable from normal echoes because they do not appear in the same place on successive rotations of the scanner.

Be sure to turn off the interference rejector when no interference exists – weak targets may be missed.



Radar interference

1. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
2. Press the SIGNAL PROC. soft key.



SIGNAL PROCESS soft keys

3. Press the I. REJ soft key successively to choose the interference rejection level desired; LOW, MED, HIGH or OFF. HIGH provides maximum interference rejection.
4. Press the RETURN soft key to finish.

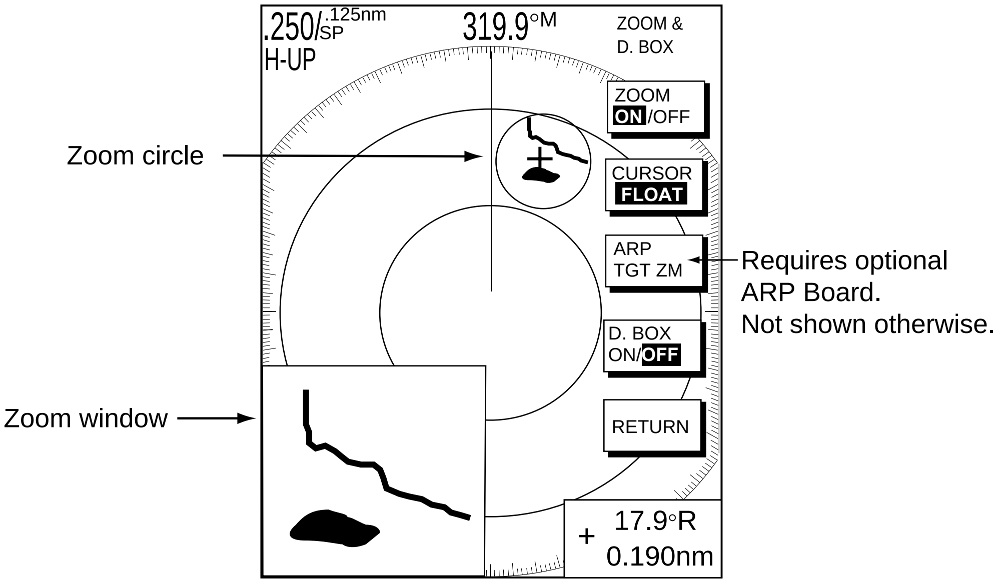
The display shows IR L (Low), IR M (Medium) or IR H (High) when the interference rejector is on.

2.15 Zoom

The zoom feature allows you to double the size of the area selected with the "zoom circle." It is available on any range but is inoperative in true motion and when the display is shifted.

2.15.1 Zooming in on radar targets

1. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
2. Use the trackball to set the cursor where you want to zoom.
3. Press the ZOOM & D. BOX soft key to show ZOOM & D. BOX soft keys.
4. Press the ZOOM ON/OFF soft key to select ON. A solid circle, called the "zoom circle," appears on the display.
5. To release the cursor, press the CURSOR FLOAT soft key. (The solid circle changes to a dashed one.) To relocate the zoom circle, select location with the trackball, then press the CURSOR LOCK key.
6. To quit the zoom function, press the ZOOM ON/OFF soft key to select OFF.

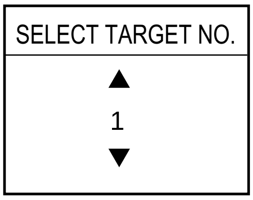


Zoom

2.15.2 Zooming in on ARP, TTM targets

You may zoom in on TTM (Tracked Target Message) and ARP targets. TTM targets can come from a NavNet connected radar, or from other ARP radar that is outputting the TTM message. (TTM is a NMEA 0183 data sentence that is an available output from some ARP capable radar.) Target numbers must be turned on to use this function. This can be done by enabling the target ID number option in the ARP SETUP menu.

1. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
2. Press the ZOOM/D. BOX soft key to show ZOOM & D. BOX soft keys.
3. Press the ZOOM ON/OFF soft key to select ZOOM ON.
4. Press the ARP TGT ZM soft key.



Target no. selection window

5. Use the [ENTER] knob to select number (1-10), then push the [ENTER] knob. If the target number does not exist several beeps sound and the zoom function is cancelled.

To cancel, press the CURSOR LOCK soft key.

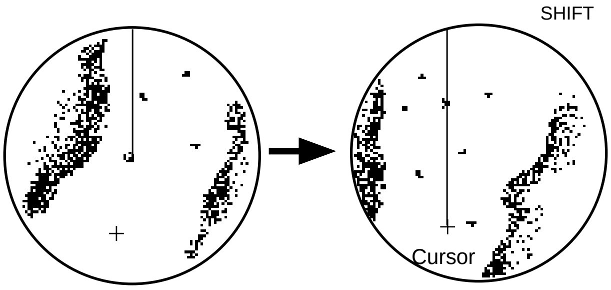
2.16 Shifting the Picture

Own ship position, or sweep origin, can be displaced manually or automatically to expand the view field without switching to a larger scale.

2.16.1 Manual shift

The sweep origin can be shifted in any presentation mode to a point specified by the cursor by up to 60% of the range in use in any direction.

1. Locate the cursor anywhere within the effective radius of the display.
2. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
3. Press the RADAR DISPLY soft key.
4. Press the SHIFT soft key.
5. Press the MANUAL soft key to shift. The heading line shifts to the cursor location. SHIFT appears at right-hand corner of the display.
6. To cancel shift, press the RADAR DISPLY, SHIFT and OFF soft keys in that order.



Place cursor where desired.

Press the MANUAL soft key.

Shifting the picture manually

2.16.2 Automatic shift

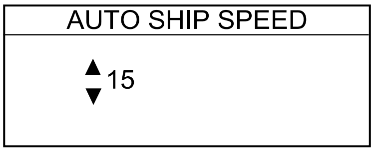
The amount of automatic shift is calculated with speed, and the amount is limited to 60% of the range in use. For example, if you set the shift speed setting for 15 knots and the ship is running at 10 knots, the amount of shift will be about 40%. The formula for determining shift amount is as shown below.

$$\frac{\text{Ship's speed}}{\text{Shift speed setting}} \times 0.6 = \text{Amount of shift(\%)}$$

Automatic shift mode is only available in the head-up mode.

Setting automatic shift maximum speed

1. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
2. Press the RADAR DISPLY soft key.
3. Press the SHIFT soft key to show the shift soft keys.
4. Press the AUTO S.SPD soft key to display the auto ship speed setting window.



Auto ship speed setting window

5. Adjust the trackball or [ENTER] knob to set the maximum speed of your vessel, and then push the [ENTER] knob or the ENTER soft key to set. The setting range is 1-999 kt and the default setting is 15 kt.
6. Press the RETURN soft key to finish.

Automatic shift

Press the AUTO key to automatically shift the sweep origin. To cancel shift, press the RADAR DISPLY, SHIFT and OFF soft keys in that order.

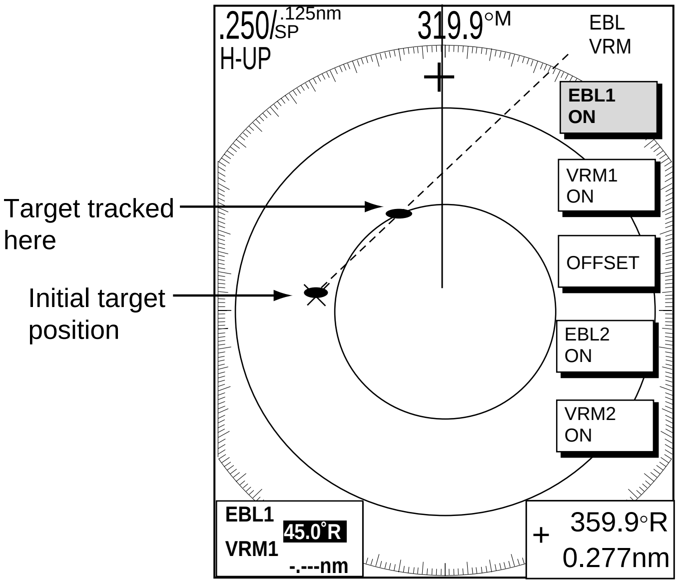
2.17 Using the Offset EBL

The offset EBL can be used to predict a potential collision course. It can also be used to measure the range and bearing between two targets.

2.17.1 Predicting collision course

The procedure below may be used to check if a radar target is on a potential collision course with your vessel.

1. Press the [EBL/VRM] key to show the EBL/VRM soft keys.
2. Press the EBL1 ON soft key to turn on the EBL1.
3. Press the OFFSET soft key. The origin of EBL1 moves to the cursor position and an “X” appears at the cursor position.
4. Use the trackball to place the cursor on the radar target which looks like it might be on a collision course with own ship.
5. Push the [ENTER] knob to fix the origin position.
6. After waiting for a few minutes (at least three minutes), rotate the [ENTER] knob so the EBL bisects the target at the new position. If the target tracks along the EBL towards the center of the display (your ship’s position), the target may be on a collision course with your vessel.
7. To cancel the offset EBL, press the OFFSET soft key.

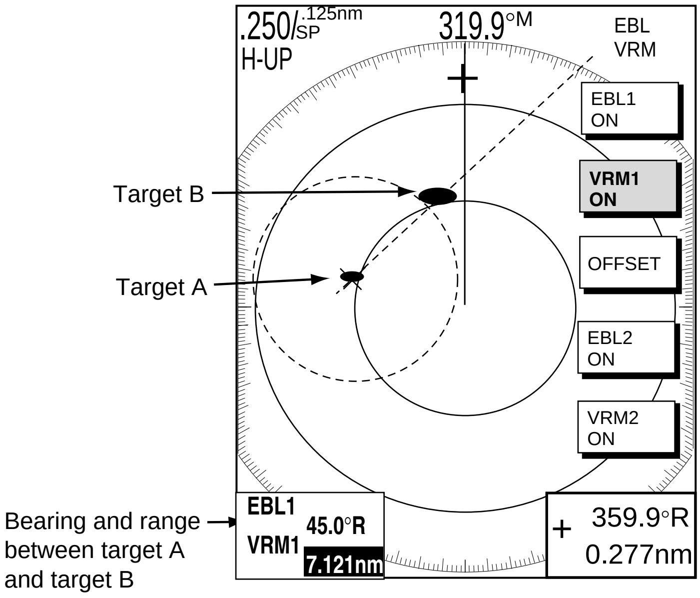


Predicting collision course with the offset EBL

2.17.2 Measuring range & bearing between two targets

The procedure which follows shows how to measure the range and bearing between two targets, using the targets “A” and “B” in the figure below as an example.

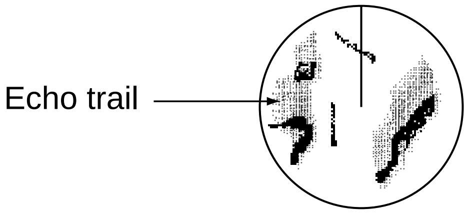
1. Operate the trackball to place the cursor on the target “A.”
2. Press the [EBL/VRM] key to show the EBL/VRM soft keys.
3. Press the EBL1 ON soft key to turn on the EBL1.
4. Press the OFFSET soft key. The origin of EBL1 moves to the cursor position, which is marked with an “X.”
5. Rotate the [ENTER] knob so the EBL bisects the target “B.”
6. Press the [ENTER] knob.
7 Press the VRM1 ON soft key and then rotate the [ENTER] knob to place the VRM1 on the inner edge of the target “B.”
8 Look at the indications for VRM1 and EBL1 to find the range and bearing between the two targets.
9 To cancel the offset EBL, press the OFFSET key.



Measuring range and bearing between two targets

2.18 Echo Trails

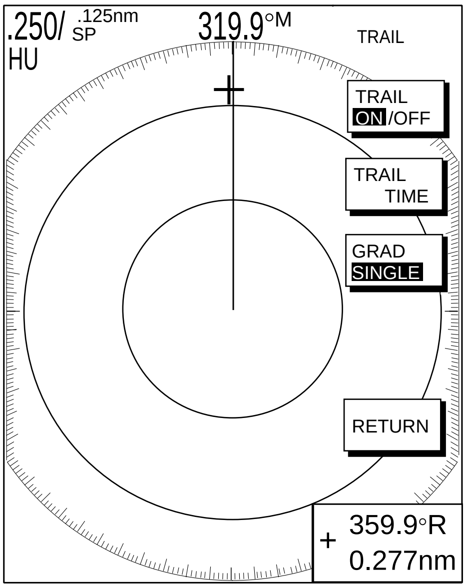
Echo trails are simulated afterglow of target echoes that represent their movements relative or true to own ship. This function is useful for alerting you past possible collision situations.



Sample echo trails

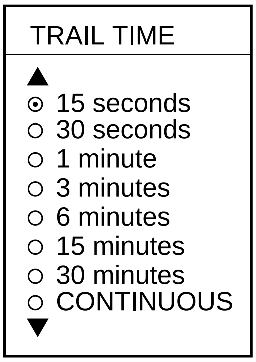
2.18.1 Trail time

1. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
2. Press the TARGET soft key.
3. Press the TRAIL soft key.



Trail soft keys

4. Press the TRAIL TIME soft key to show the trail time window.



Trail time window

4. Use the trackball to select time desired.
5. Press the ENTER soft key.
6. Press the RETURN soft key twice to finish.

2.18.2 Starting echo trails

1. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
2. Press the TARGET soft key.
3. Press the TRAIL soft key.
4. Press the TRAIL ON/OFF soft key to select ON.
5. Press the RETURN soft key twice to finish.

“TRAIL,” the echo trail time selected and elapsed time appear at the top right-hand corner of the display. Then, afterglow starts extending from all targets. Trails are restarted when the range or mode is changed and zoom or shift is turned on.

For continuous trails, the maximum continuous trail time is 99 minutes and 59 seconds. When the elapsed time clock counts up to that time, the elapsed time display resets to zero and trails begin again.

To turn off echo trail, press the TRAIL ON/OFF soft key to select OFF at step 4 in the above procedure.

2.18.3 Trail gradation

The echo trails can be shown in single or multiple gradations. Multiple gradation paints the trails thinner with time, like the afterglow on an analog PPI radar.

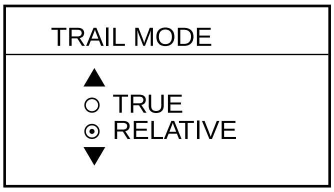
1. If not displayed, press the [HIDE/SHOW] soft key to show the radar soft keys.
2. Press the TARGET and TRAIL soft keys.
3. Press the GRAD soft key to select SINGLE or MULTI as appropriate.
4. Press the RETURN soft key twice to finish.

Multitone and monotone trails

2.18.4 Echo trail mode

Echo trails may be shown in Relative or True motion. (True motion requires speed and heading inputs.)

1. Press the [MENU] key.
2. Press the RADAR DISPLAY SETUP key.
3. Choose TRAIL MODE, then press the EDIT soft key.

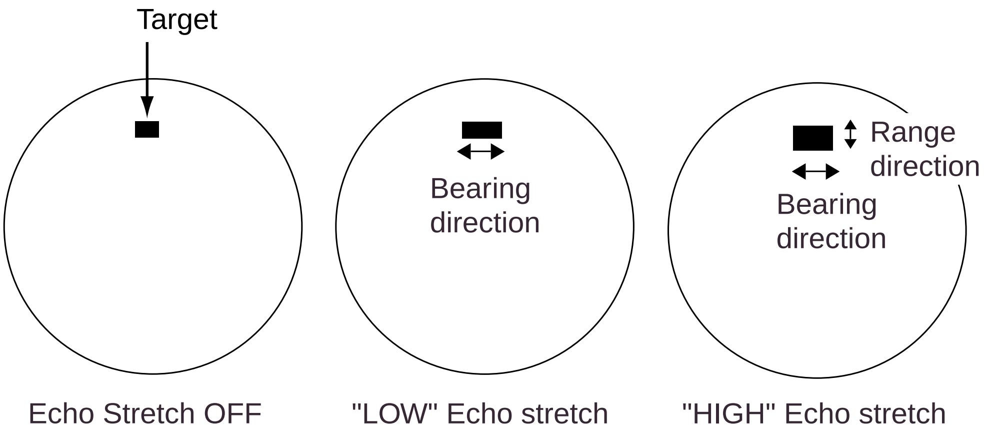


Trail mode window

4. Select TRUE or RELATIVE as appropriate, then press the ENTER soft key.
5. Press the [MENU] key to close the menu.

2.19 Echo Stretch

Normally, the reflected echoes from long range targets appear on the display as weaker and smaller blips even though they are compensated by the radar’s internal circuitry. The echo stretch function magnifies these small blips in all ranges. Two types of echo stretch are available: ES LOW which stretches echoes in bearing direction and ES HIGH which stretches them in both range and bearing directions.



Types of echo stretch

This function magnifies not only targets but also sea clutter and radar interference. For this reason, be sure sea clutter and radar interference are properly suppressed before activating the echo stretch.

1. If not displayed, press the [HIDE/SHOW] key to show the radar soft keys.
2. Press the SIGNAL PROC. soft key.
3. Press the E. STR soft key to select HIGH, LOW or OFF as appropriate.
4. Press the RETURN soft key to finish.

The display shows ES H (High) or ES L (Low) when the echo stretch is on.

2.20 Echo Averaging

The echo averaging feature effectively suppresses sea clutter. Echoes received from stable targets such as ships appear on the screen at almost the same position during every rotation of the antenna. On the other hand, unstable echoes such as sea clutter appear at random positions.

To distinguish real target echoes from sea clutter, echo average performs scan-to-scan correlation. Correlation is made by storing and averaging echo signals over successive picture frames. If an echo is solid and stable, it is presented in its normal intensity. Sea clutter is averaged over successive scans resulting in the reduced brilliance, making it easier to discriminate real targets from sea clutter.

To properly use the echo average function, it is recommended to first suppress sea clutter with the A/C SEA control and then do the following:

1. If not displayed, press the [HIDE/SHOW] key to display the radar soft keys.
2. Press the SIGNAL PROC. soft key.
3. Press the E. AVG soft key to select desired echo averaging.

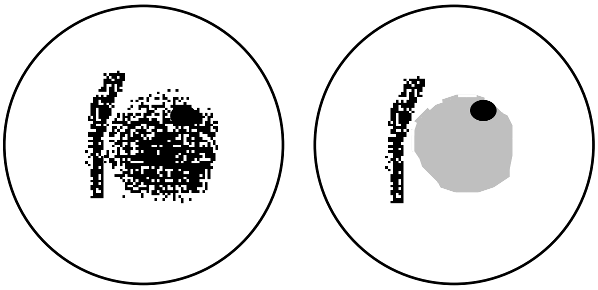
   OFF: No averaging

   LOW: Helps distinguish targets from sea clutter and suppresses brilliance of unstable echoes.

   MED: Distinguishes small stationary targets such as navigation buoys.

   HIGH: Stably displays distant targets.
4. Press the RETURN soft key to finish.

The display shows EAV L, EAV M or EAV H when echo averaging is on.



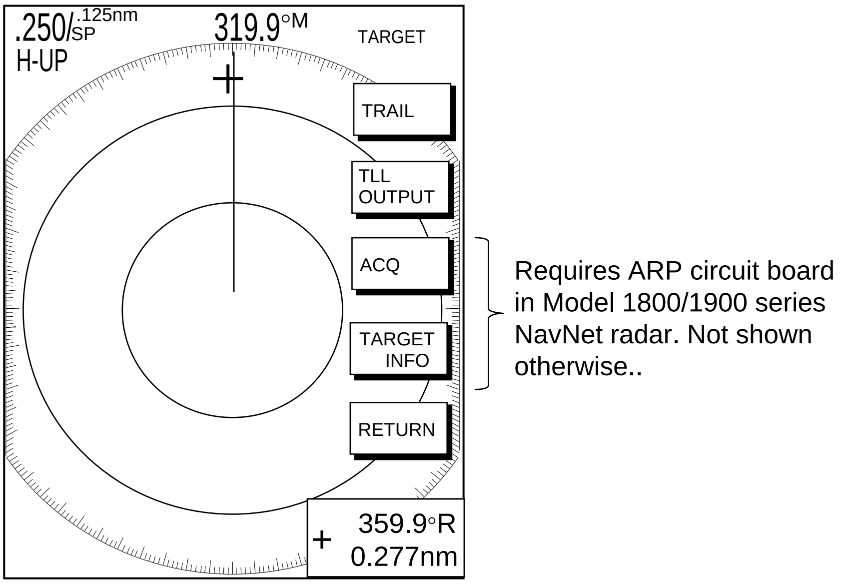
(a) Echo average OFF (b) Echo average ON

Effect of echo averaging

2.21 Outputting TLL Data

Target position data can be output to units of the network and shown on their plotter screens with the TLL mark (⊗). This function requires position and heading data.

1. Operate the trackball to place the cursor on the target whose position you wish to output.
2. If not displayed, press the [HIDE/SHOW] key to display the radar soft keys.
3. Press the TARGET soft key.



TARGET soft keys

4. Press the TLL OUTPUT soft key to output target position data. The TLL mark is inscribed on the plotter display at the target's position the moment the TLL OUTPUT soft key was pressed. Further, that position is recorded as a waypoint on all NavNet units, under the youngest empty waypoint number on each NavNet unit.
5. Press the RETURN soft key to finish.

Note: The screen of the TLL recipient may be temporarily interrupted when receiving TLL from another NavNet display unit. Press any key to restore normal operation.

2.22 Guard Alarm

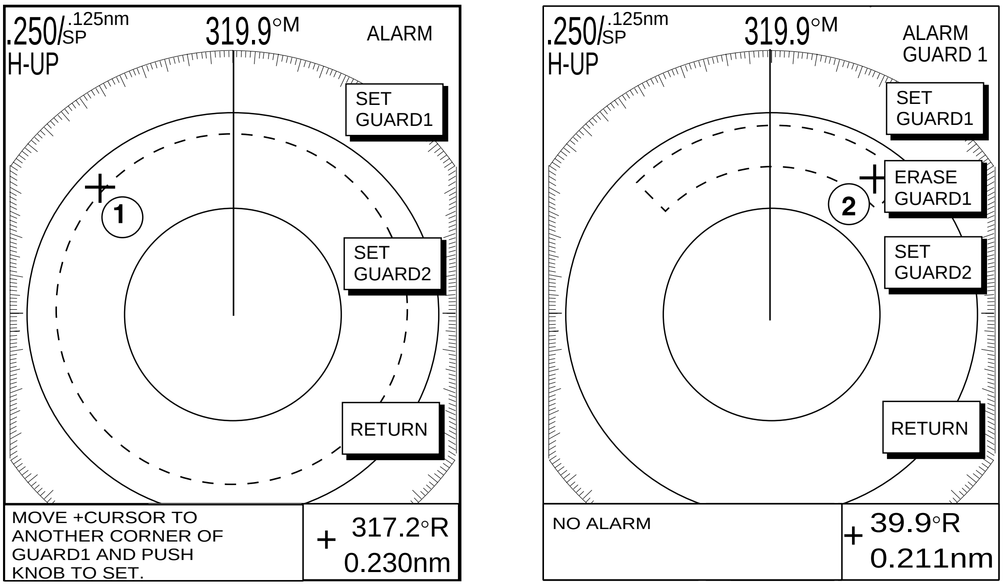
The guard alarm allows the operator to set the desired range and bearing for a guard zone. When ships, islands, landmasses, etc. violate the guard zone, an audio alarm sounds and the offending target blinks to call the operator’s attention.

> ⚠ **CAUTION**
>
> - **The alarm should not be relied upon as the sole means for detecting possible collision situations.**
> - **A/C SEA, A/C RAIN and GAIN controls should be properly adjusted to be sure the alarm system does not overlook target echoes.**

2.22.1 Setting a guard alarm zone

To set a guard alarm zone, set the radar to transmit and do the following:

1. Press the [ALARM] key.
2. Use the trackball to set the cursor on the top left corner (or top right corner) of the guard zone you want to set, then press the SET GUARD1 or SET GUARD2 soft key, depending on which guard zone you want to set.
3. Use the trackball to set the cursor on the bottom right corner (or top left corner) of the guard zone area, then push the [ENTER] knob.
4. Press the RETURN soft key to finish.



(1) Drag cursor to top (or bottom) corner for guard zone and press the SET GUARD1 or SET GUARD2 soft key.

(2) Drag cursor diagonally to bottom (or top) corner for guard zone and press the [ENTER] knob.

How to set a guard alarm zone

The equipment then searches for targets inside the guard zone to determine guard alarm type. If a target is found inside the guard zone, the guard zone type becomes an “Outward guard alarm,” and any target exiting the guard zone will trigger the audio alarm. If no target is found, the guard zone type becomes an “Inward guard alarm,” and any targets entering the guard zone will trigger the audio alarm. The guard alarm type is shown as G1(G2) IN or G1(G2) OUT.

Note 1: When the radar range is less than the guard zone range, the audio alarm sounds and the alarm icon appears. Press the [CLEAR] key to silence the alarm. Press the [ALARM] key and the message “GUARD1(2) IS OUTSIDE RADAR RANGE” appears. Reselect appropriate range.

Note 2: If the network radar is set to standby while the guard alarm is active, the guard alarm is cancelled. The guard alarm is redisplayed when the radar is set to transmit again.

Note 3: If the network radar is set to standby while the radar picture is not displayed, the audio alarm sounds. Press the [ALARM] key and the message “STBY MODE HAS BEEN SELECTED. GUARD/WTCHMN CANCELED.” or “GUARD/WATCHMAN CANCELED. STBY/TX SELECTED.” appears.

2.22.2 When the alarm is violated…

Any radar target violating the guard zone will flash, the audio alarm sounds, and the alarm icon appears. Additionally the message “TARGET ENTERED INTO GUARD1(GUARD2)” or “TARGET LEFT FROM GUARD1(GUARD2)” is displayed at the bottom of the screen. Press the [CLEAR] key to silence the alarm. When this is done, “G1(G2) ACK” replaces G1(G2) IN(OUT) at the top right corner of the display. This means the alarm is temporarily deactivated. To reactivate the alarm, press the SET GUARD1 or SET GUARD2 soft key as appropriate.

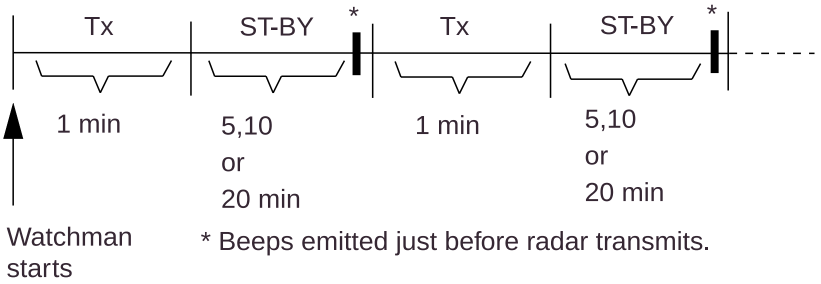
2.22.3 Cancelling the guard alarm

1. Press the [ALARM] key to show the ALARM menu.
2. Press the ERASE GUARD1 or ERASE GUARD2 soft key as appropriate.
3. Press the RETURN soft key to finish.

2.23 Watchman

2.23.1 How watchman works

The watchman function periodically transmits radar pulses for one minute to check for targets in a guard zone. If a target is found in the zone, watchman is cancelled, the audio alarm sounds and the radar continues transmitting. If no target is found the radar goes into standby for the number of minutes designated on the RADAR DISPLAY SETUP menu. This feature is useful when you do not need the radar's function continuously but want to be alerted to radar targets in a specific area. "WTCH" appears at the top left corner when Watchman is active.



How watchman works

2.23.2 Turning on/off watchman

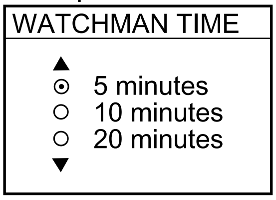
1. Set a guard zone. (See the paragraph 2.22.)
2. If not displayed, press the [HIDE/SHOW] key to display the radar soft keys.
3. Press the NAV FUNC soft key.
4. Press the W. MAN ON/OFF soft key to select ON or OFF as appropriate.
5. Press the RETURN soft key to finish.

Note: When the watchman is activated and no guard zone is active, the message "PLEASE SET GUARD ZONE. PRESS ANY KEY TO CONTINUE." appears. Press any key and then set a guard zone.

2.23.3 Setting watchman stand-by interval

The watchman standby interval, that is, the number of minutes the radar is in standby, can be set to 5, 10 or 20 minutes as follows:

1. Press the [MENU] key.
2. Press the RADAR DISPLAY SETUP soft key.
3. Select WATCHMAN TIME, then press the EDIT soft key.

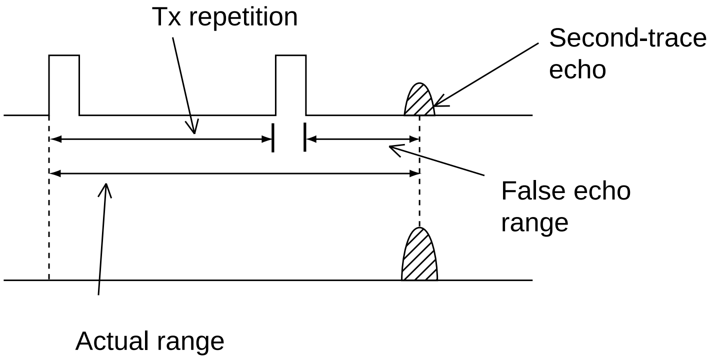


Watchman window

4. Select time desired, then press the ENTER soft key.
5. Press the [MENU] key to close the menu.

2.24 Suppressing Second-trace Echoes

In certain situations, echoes from very distance targets may appear as false echoes (second-trace echoes) on the screen. This occurs when the return echo is received one transmission cycle later, or after a next radar pulse has been transmitted.



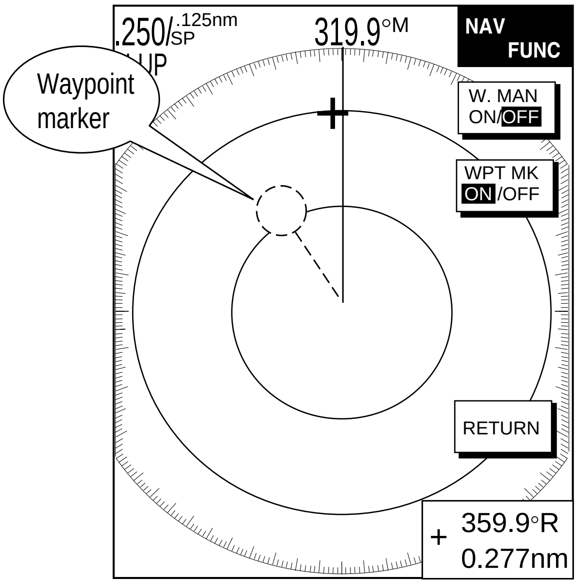
Second-trace echoes

To activate or deactivate the second-trace echo rejector do the following:

1. Press the [MENU] key.
2. Press the RADAR DISPLAY SETUP soft key.
3. Use the trackball to select 2ND ECHO REJECTION, then press the EDIT soft key.
4. Choose ON or OFF as appropriate, then press the ENTER soft key.
5. Press the [MENU] key to close the menu.

2.25 Waypoint Marker

A waypoint marker, showing the location of the destination waypoint set on the plotter, may be inscribed on the radar display.



Waypoint marker

1. If not already shown, press the [HIDE/SHOW] key to display the radar soft keys.
2. Press the NAV FUNC soft key.
3. Press the WPT MK ON/OFF soft key to select ON or OFF as appropriate.
4. Press the RETURN soft key to finish.

2.26 ARP, TTM Operation

With the optional ARP circuit board, you can manually and automatically acquire and track ten targets. Once a target is acquired automatically or manually it is automatically tracked within 0.1 to 32 nm. If the FURUNO heading sensor PG-1000 is used, the data sentence “RMC” is necessary.

Alternatively, you can display the tracks of other ships by receiving the data sentence TTM (Tracked Target Message) via the NETWORK or NMEA port on the display unit. However, targets cannot be acquired.

Usage precautions for ARP

⚠ WARNING

No one navigational aid should be relied upon for the safety of vessel and crew. The navigator has the responsibility to check all aids available to confirm position. Electronic aids are not a substitute for basic navigational principles and common sense.

- This auto plotter automatically tracks an automatically or manually acquired radar target and calculates its course and speed, indicating them by a vector. Since the data generated by the auto plotter are based on what radar targets are selected, the radar must always be optimally tuned for use with the auto plotter, to ensure required targets will not be lost or unwanted targets such as sea returns and noise will not be acquired and tracked.

- A target does not always mean a land-mass, reef, ships or other surface vessels but can imply returns from sea surface and clutter. As the level of clutter changes with environment, the operator should properly adjust the A/C SEA, A/C RAIN and GAIN controls to be sure target echoes are not eliminated from the radar screen.

⚠ CAUTION

The plotting accuracy and response of this auto plotter meets IMO standards. Tracking accuracy is affected by the following:

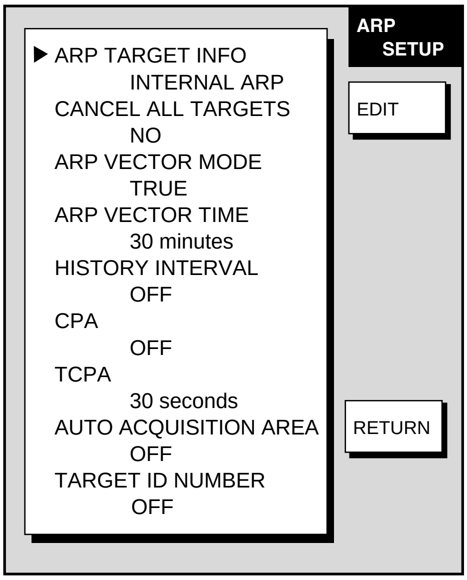
- Tracking accuracy is affected by course change. One to two minutes is required to restore vectors to full accuracy after an abrupt course change. (The actual amount depends on gyrocompass specifications.)
- The amount of tracking delay is inversely proportional to the relative speed of the target. Delay is on the order of 15-30 seconds for high relative speed; 30-60 seconds for low relative speed.

Display accuracy is affected by the following:

- Echo intensity
- Radar transmission pulsewidth
- Radar bearing error
- Gyrocompass error
- Course change (own ship or target)

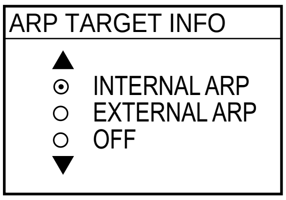
2.26.1 Activating/deactivating ARP, TTM

1. Press the [MENU] key followed by the ARP SETUP soft key to show the ARP SETUP menu.



ARP setup menu

2. Select ARP TARGET INFO, then press the EDIT soft key to show the ARP target info window.



ARP target info window

3. Select INTERNAL ARP, EXTERNAL ARP or OFF as appropriate.

   INTERNAL ARP: The radar source must be an ARP-equipped Model 1800/1900 series NavNet radar. Select this item also for a NavNet unit being fed ARP targets.

   EXTERNAL ARP: Receive TTM data sentence via NMEA or NETWORK port. Target tracks are shown but targets cannot be acquired.

   OFF: Turns off the ARP or TTM display.

4. Press the ENTER soft key.
5. Press the [MENU] key to close the menu.

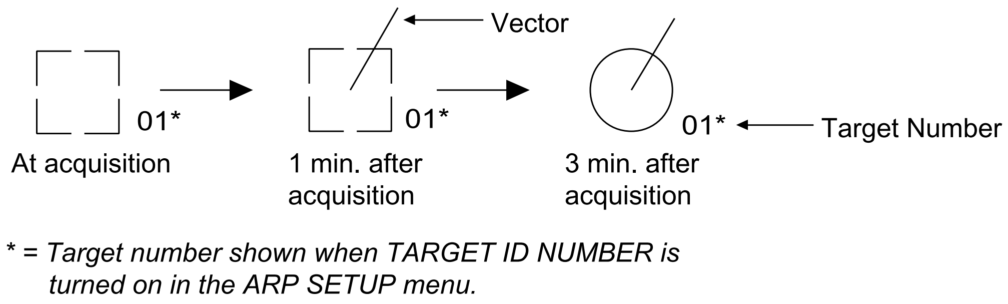
2.26.2 Acquiring and tracking targets (ARP)

Ten targets may be acquired and tracked manually and automatically. When you attempt to acquire an eleventh target, the message “ARP FULL – ALREADY TRACKING 10 TARGETS!” appears for five seconds. To acquire another target, terminate tracking of an unnecessary target as shown in the paragraph “2.26.4 Terminating tracking of ARP targets.”

Manual acquisition

1. If not already shown, press the [HIDE/SHOW] key to show the radar soft keys.
2. Press the TARGET soft key.
3. Place the cursor on the target to acquire, then press the ACQ soft key.
4. Press the RETURN soft key.

The plot symbol changes over time as below. A vector appears about one minute after acquisition, indicating the target’s motion trend.

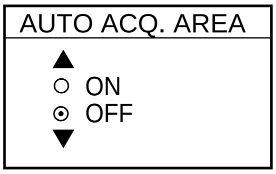


ARP plot symbols

Automatic acquisition

The ARP can acquire up to ten targets automatically by setting an automatic acquisition area. When automatic acquisition is selected after acquiring targets manually, only the remaining capacity for targets may be automatically acquired. For example, if seven targets have been manually acquired, three targets may be automatically acquired.

1. Press the [MENU] key to show the main menu.
2. Press the ARP SETUP soft key to show the ARP SETUP menu.
3. Operate the trackball to select AUTO ACQUISITION AREA.
4. Press the EDIT soft key to show the automatic acquisition area window.

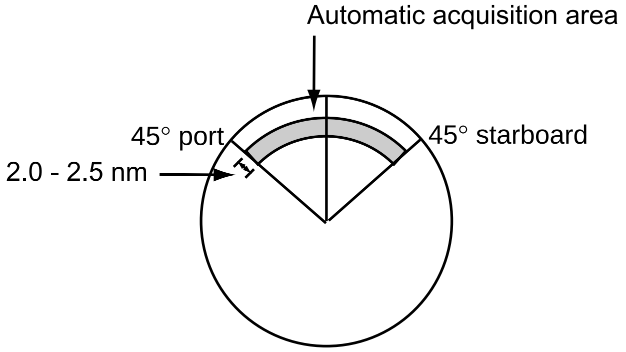


Automatic acquisition area window

5. Select ON, then press the ENTER soft key.

6. Press the [MENU] key to close the menu. An acquisition area of 2.0 to 2.5 miles in range and ±45º on either side of the heading line in bearing appears.

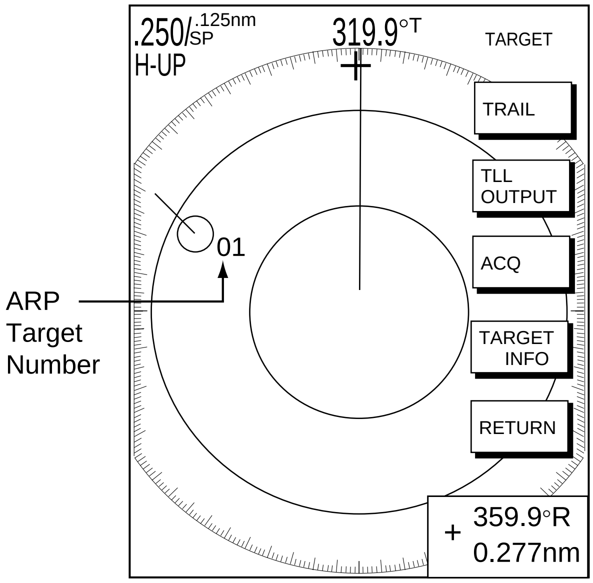
Note: Targets being tracked in automatic acquisition are continuously tracked when switching to manual acquisition.



Automatic acquisition area

2.26.3 Displaying target number (ARP, TTM)

Target number can be shown for ARP and TTM targets as below.



ARP target number

1. Press the [MENU] key.
2. Press the ARP SETUP soft key.
3. Select TARGET ID NUMBER.
4. Press the EDIT soft key.
5. Select ON or OFF as appropriate.
6. Press the ENTER soft key.
7. Press the [MENU] key to close the menu.

2.26.4 Terminating tracking of ARP targets

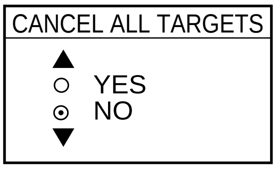
When ten targets have been acquired, no more acquisition occurs unless targets are cancelled. If you need to acquire additional targets, you must first cancel one or more individual targets, or all targets, using one of the procedures below.

Terminating tracking of selected targets

1. Place the cursor on the target to terminate tracking.
2. Press the [CLEAR] key to terminate track and erase the target.

Terminating tracking of all targets

1. Press the [MENU] key followed by the ARP SETUP soft key.
2. Select CANCEL ALL TARGETS.
3. Press the EDIT soft key.



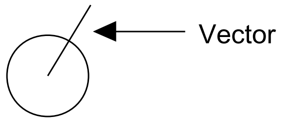
Cancel all targets window

4. Select YES.
5. Press the ENTER soft key.
6. Press the [MENU] key to close the menu.

2.26.5 Setting vector attributes (ARP)

What is a vector?

A vector is a line extending from a tracked target which shows estimated speed and course of the target. The vector tip shows an estimated position of the target after the selected vector time elapses. It can be useful to extend the vector length (time) in order to evaluate the risk of collision with any target.



Vector

Vector reference, vector time

You may reference the vectors to North (True, requires heading and speed data) or ship's heading (relative) as desired. Vector time can be set to 30 seconds, 1, 3, 6, 15 or 30 minutes.

1. Press the [MENU] key followed by the ARP SETUP soft key to show the ARP SETUP menu.
2. Operate the trackball to select ARP VECTOR MODE.
3. Press the EDIT soft key to show the ARP vector mode window.

ARP VECTOR MODE
▲ ⊙ RELATIVE ○ TRUE ▼

ARP vector mode window

4. Select TRUE or RELATIVE as appropriate.
5. Press the ENTER soft key.
6. Select ARP VECTOR TIME, then press the EDIT soft key to show the ARP vector time window.

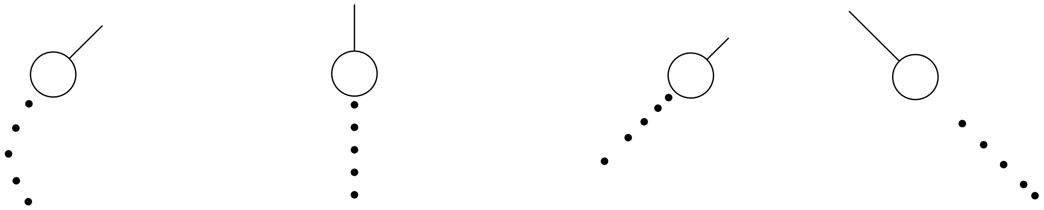
ARP VECTOR TIME
▲ ⊙ 30 seconds ○ 1 minute ○ 3 minutes ○ 6 minutes ○ 15 minutes ○ 30 minutes ▼

ARP vector time window

7. Operate the trackball to select vector time among 30 sec, 1 min, 3 min, 6 min, 15 min and 30 min.
8. Press the ENTER soft key.
9. Press the [MENU] key to close the menu.

2.26.6 Displaying past position (ARP)

This ARP can display time-spaced dots (maximum ten dots) marking the past positions of any targets being tracked. You can evaluate a target's actions by the spacing between dots. Below are examples of dot spacing and target movement.



(a) Ship turning   (b) Ship running straight   (c) Ship reduced speed   (d) Ship increased speed

Past position displays

To turn the past position display on or off:

1. Press the [MENU] key followed by the ARP SETUP soft key.
2. Operate the trackball to select HISTORY INTERVAL.
3. Press the EDIT soft key to show the history interval window.

HISTORY INTERVAL
▲
⊙ OFF
○ 30 seconds
○ 1 minute
○ 3 minutes
○ 6 minutes
▼

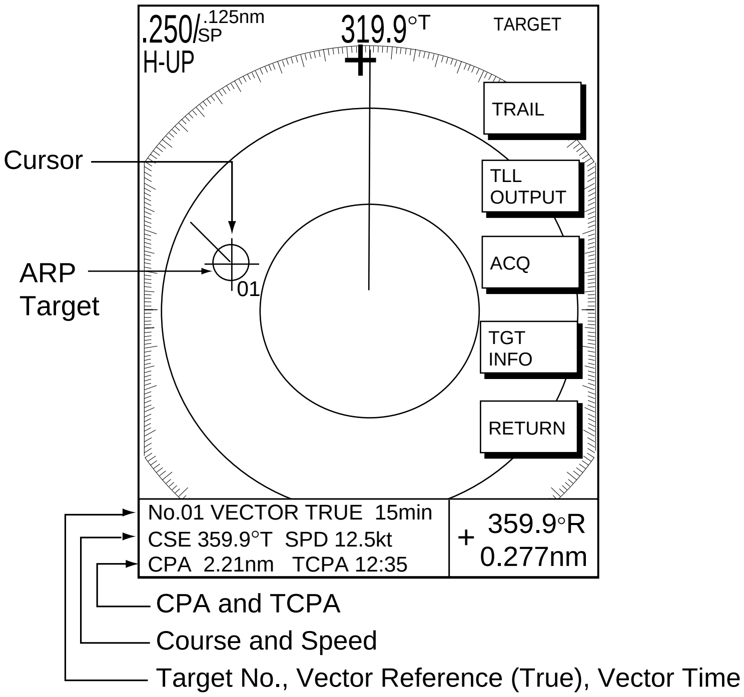
Plot interval window

4. Operate the trackball to select history interval among 30 sec, 1 min, 3 min and 6 min, or select OFF to turn off the past position display.
5. Press the ENTER soft key.
6. Press the [MENU] key to close the menu.

2.26.7 ARP, TTM target data

You can show motion trends (range, bearing, course, speed, CPA and TCPA) for ARP or TTM targets. Note that TARGET ID NUMBER, in the ARP SETUP menu, must be turned on to display this data.

1. Place the cursor on the target whose data you want to see.
2. If not already displayed, press the [HIDE/SHOW] key to show the radar soft keys.
3. Press the TARGET and TARGET INFO soft keys. The data of the selected target appears at the bottom left-hand corner of the display. (If an EBL/VRM data box is displayed ARP data will be under it.)
4. Press the RETURN soft key to finish.
5. To erase the ARP/TTM data box, select the corresponding target with the cursor, then press the [CLEAR] key.



ARP target data

2.26.8 CPA/TCPA alarm (ARP)

When the predicted CPA of any target becomes smaller than a preset CPA alarm range or its predicted TCPA less than a preset TCPA alarm limit, an audio alarm sounds and the speaker icon appears. In addition, the target plot symbol of the offending target changes to a triangle and flashes together with its vector. You may silence the audio alarm with the [CLEAR] key. Press the [ALARM] key and the message “COLLISION ALARM” appears. Press the CLEAR ALARM soft key to acknowledge the alarm. The flashing of the triangle plot symbol continues until you intentionally terminate tracking of the target. The ARP continuously monitors the predicted range at the Closest Point of Approach (CPA) and predicted time to CPA (TCPA) of each track to own ship.

This feature helps alert you to targets which may be on a collision course with own ship. However, it is important that gain, A/C SEA, A/C RAIN and other radar controls are properly adjusted and the ARP is set up so that it can track targets effectively.

CPA/TCPA alarm ranges must be set up properly taking into consideration the size, tonnage, speed, turning performance and other characteristics of own ship.

⚠ CAUTION

The CPA/TCPA alarm should never be relied upon as the sole means for detecting the risk of collision. The navigator is not relieved of the responsibility to keep visual lookout for avoiding collisions, whether or not the radar or other plotting aid is in use.

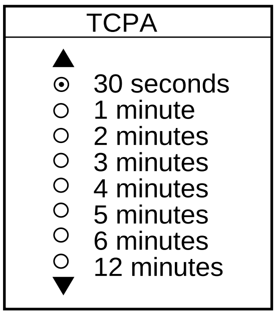
Follow the steps shown below to set the CPA/TCPA alarm range:

1. Press the [MENU] key followed by the ARP SETUP soft key.
2. Operate the trackball to select CPA.
3. Press the EDIT soft key to show the CPA window.

CPA
▲
⊙ OFF
○ 0.5nm
○ 1nm
○ 2nm
○ 3nm
○ 5nm
○ 6nm
▼

CPA window

4. Select a CPA limit desired from 0.5 nm, 1 nm, 2 nm, 3 nm, 5 nm and 6 nm with the trackball.
5. Press the ENTER soft key. The ARP SETUP menu reappears.
6. Press the trackball to select TCPA.
7. Press the EDIT soft key to show the TCPA window.

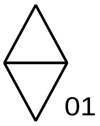


TCPA window

8. Select a TCPA limit among 30 sec, 1 min, 2 min, 3 min, 4 min, 5 min, 6 min and 12 min.
9. Press the ENTER soft key.
10. Press the [MENU] key to close the menu.

2.26.9 Lost target alarm (ARP)

When the system detects a lost target, the target symbol becomes a diamond and tracking is discontinued after one minute.



Lost target mark

Canceling a lost target

1. Place the cursor on the target.
2. Press the [CLEAR] key.

2.27 Interpreting the Radar Display

2.27.1 General

Minimum and maximum ranges

Minimum range

The minimum range is defined by the shortest distance at which, using a scale of 1.5 or 0.75 nm, a target having an echoing area of 10 m^2 is still shown separate from the point representing the antenna position. It is mainly dependent on the pulselength, antenna height, and signal processing such as main bang suppression and digital quantization. It is best to use the shortest possible range as long as the clarity and definition of the picture remain good.

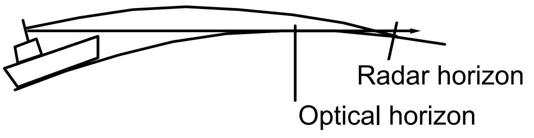
Maximum range

The maximum detecting range of the radar, Rmax, varies considerably depending on several factors such as the height of the antenna above the waterline, the height of the target above the sea, the size, shape and material of the target, and atmospheric conditions.

Under normal atmospheric conditions, the maximum range is equal to the radar horizon or a little shorter. The radar horizon is longer than the optical one by about 6% because of the diffraction property of the radar signal. Rmax is given in the following equation.

$R_{max} = 2.2 \times (\sqrt{h1} + \sqrt{h2})$

where Rmax: radar horizon (nautical miles)
h1: antenna height (m)
h2: target height (m)



Radar horizon

For example, if the height of the antenna above the waterline is 9 meters and the height of the target is 16 meters, the maximum radar range is;

$R_{max} = 2.2 \times (\sqrt{9} + \sqrt{16}) = 2.2 \times (3 + 4) = 15.4$ nm

It should be noted that the detection range is reduced by precipitation (which absorbs the radar signal).

Radar resolution

There are two important factors in radar resolution (discrimination): bearing resolution and range resolution.

Bearing resolution

Bearing resolution is the ability of the radar to display the echoes received from two targets, which are at the same range and close together, as separate targets. Bearing resolution is directly proportional to the antenna length, and inversely proportional to the radar's wavelength.

Range resolution

Range resolution is the ability to display the echoes received from two targets, which are on the same bearing and close to each other, as separate targets.

Bearing accuracy

One of the most important features of the radar is how accurately the bearing of a target can be measured. The accuracy of bearing measurement basically depends on the narrowness of the radar beam. However, the bearing is usually taken relative to the ship’s heading, and thus, proper adjustment of the heading marker at installation is an important factor in ensuring bearing accuracy. To minimize error when measuring the bearing of a target, select a range which will put the target as far out to the edge of the radar screen as possible.

Range measurement

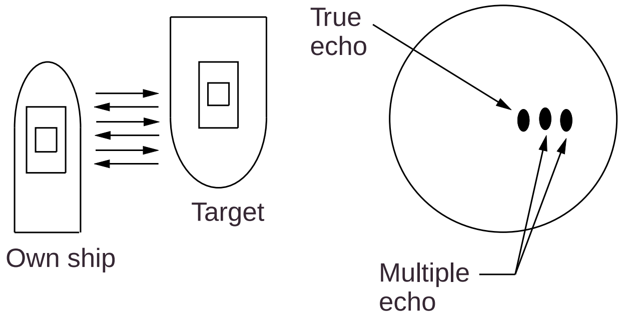
Measurement of the range to a target is also a very important function of the radar. There are three means of measuring range: the fixed range rings, the trackball and the variable range marker (VRM). The fixed range rings appear on the screen with a predetermined interval and provide a rough estimate of the range to a target. The trackball is rolled to place the cursor on the leading edge of the target. Range and bearing to the target is shown at the bottom right-hand corner of the display. The variable range marker’s diameter is increased or decreased so that the marker touches the inner edge of the target, allowing the operator to obtain more accurate range measurements.

2.27.2 False echoes

Occasionally echo signals appear on the screen at positions where there is no target or disappear even if there are targets. False target situations may be recognized, however, if you understand why they are displayed. Typical false echoes are shown below.

Multiple echoes

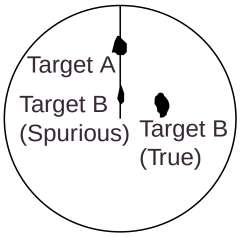
Multiple echoes occur when a transmitted pulse returns from a solid object like a large ship, bridge, or breakwater. A second, a third or more echoes may be observed on the display at double, triple or other multiples of the actual range of the target as shown below. Multiple reflection echoes can be reduced and often removed by decreasing the gain (sensitivity) or properly adjusting the [A/C SEA] control.



Multiple echoes

Sidelobe echoes

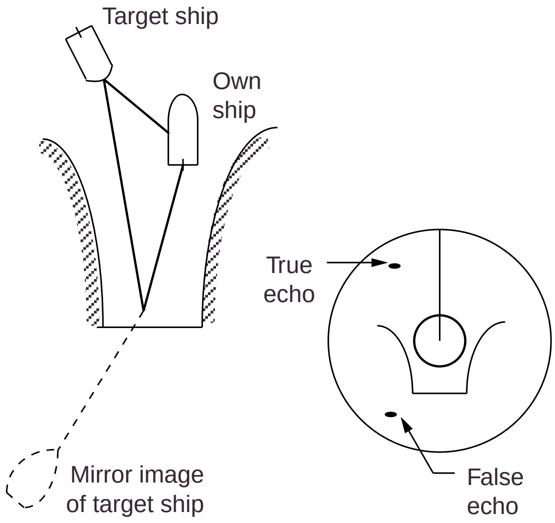
Every time the radar pulse is transmitted, some radiation escapes on each side of the beam. This stray RF is called a “sidelobe.” If a target exists where it can be detected by the sidelobes as well as the main lobe, the side echoes may be represented on both sides of the true echo at the same range. Sidelobes show usually only on short ranges and from strong targets. They can be reduced through careful reduction of the gain or proper adjustment of the A/C SEA control.



Sidelobe echoes

Virtual image

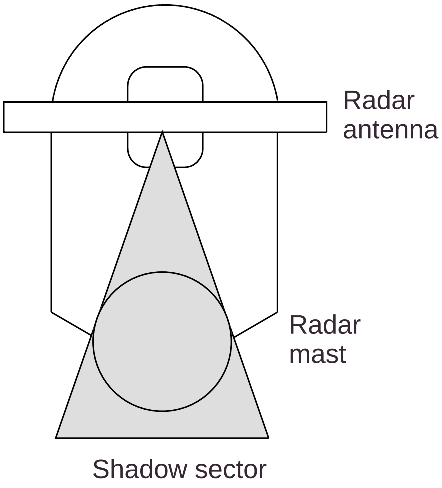
A relatively large target close to your ship may show at two positions on the screen. One of them is the true echo directly reflected by the target and the other is a false echo which is caused by the mirror effect of a large object on or close to your ship as shown in the figure below. If your ship comes close to a large metal bridge, for example, such a false echo may temporarily be seen on the screen.



Virtual image

Shadow sectors

Funnels, stacks, masts, or derricks in the path of the antenna block the radar beam. If the angle subtended at the antenna is more than a few degrees, a non-detecting sector or blind spot may be produced. Within this sector, targets can not be detected.

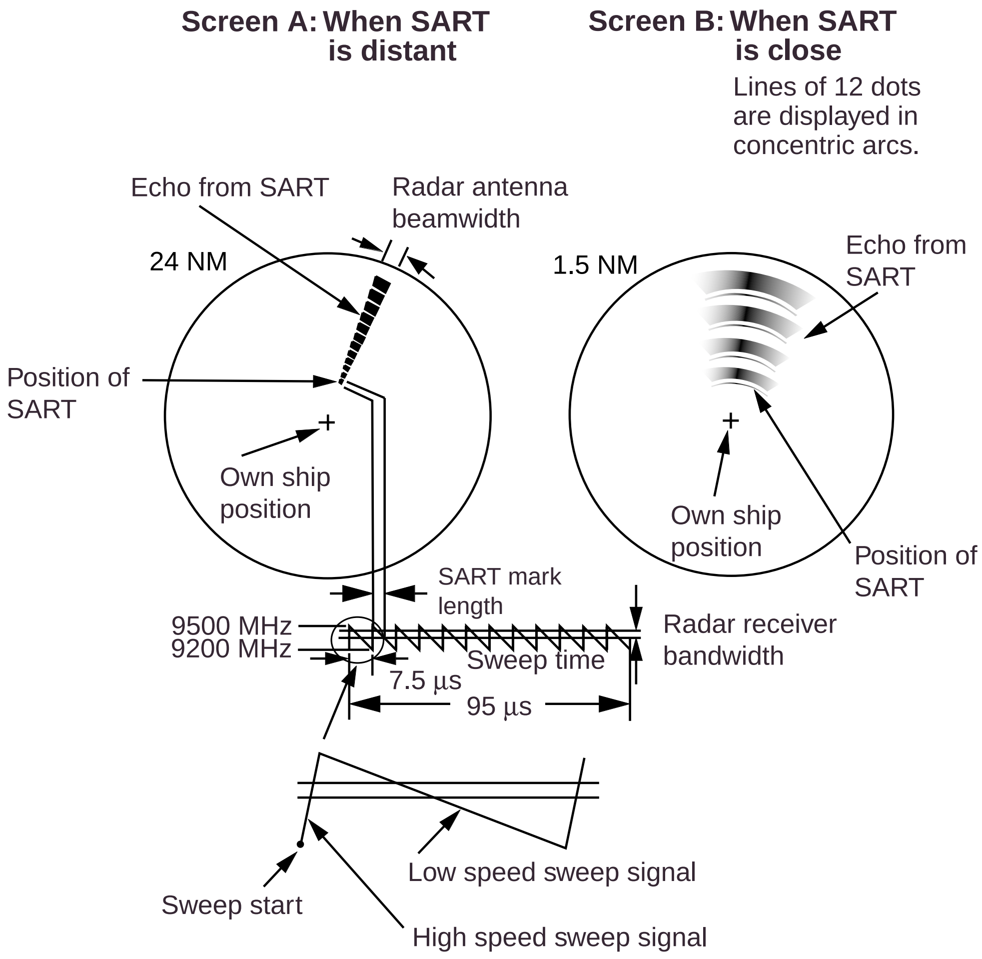


Shadow sectors

2.27.3 SART (Search and Rescue Transponder)

A Search and Rescue Transponder (SART) may be triggered by any X-Band (3 cm) radar within a range of approximately 8 nm. Each radar pulse received causes it to transmit a response which is swept repetitively across the complete radar frequency band. When interrogated, it first sweeps rapidly (0.4 µs) through the band before beginning a relatively slow sweep (7.5 µs) through the band back to the starting frequency. This process is repeated for a total of twelve complete cycles. At some point in each sweep, the SART frequency will match that of the interrogating radar and be within the pass band of the radar receiver. If the SART is within range, the frequency match during each of the 12 slow sweeps will produce a response on the radar display, thus a line of 12 dots equally spaced by about 0.64 nautical miles will be shown.

When the range to the SART is reduced to about 1 nm, the radar display may show also the 12 responses generated during the fast sweeps. These additional dot responses, which also are equally spaced by 0.64 nm, will be interspersed with the original line of 12 dots. They will appear slightly weaker and smaller than the original dots.



Appearance of SART signal on the radar display

General procedure for detecting SART response

1. Use the range scale of 6 or 12 nm as the spacing between the SART responses is about 0.6 nm (1125 m) to distinguish the SART.
2. Turn off the automatic clutter suppression (if applicable).
3. Turn off the Interference Rejector.

General remarks on receiving SART

SART range errors

When responses from only the 12 low frequency sweeps are visible (when the SART is at a range greater than about 1 nm), the position at which the first dot is displayed may be as much as 0.64 nm beyond the true position of the SART. When the range closes so that the fast sweep responses are seen also, the first of these will be no more than 150 meters beyond the true position.

Radar bandwidth

This is normally matched to the radar pulselength and is usually switched with the range scale and the associated pulselength. Narrow bandwidths of 3-5 MHz are used with long pulses on long range and wide bandwidths of 10-25 MHz with short pulses on short ranges.

Any radar bandwidth of less than 5 MHz will attenuate the SART signal slightly, so it is preferable to use a medium bandwidth to ensure optimum detection of the SART.

Radar sidelobes

As the SART is approached, sidelobes from the radar antenna may show the SART responses as a series of arcs or concentric rings. These can be removed by the use of the [A/C SEA] control although it may be operationally useful to observe the sidelobes as they may be easier to detect in clutter conditions and also they will confirm that the SART is near to the ship.

Gain

For maximum range SART detection the normal gain setting for long range detection should be used, that is, with background noise speckle visible.

A/C SEA control

For optimum range SART detection, this control should be set to the minimum. Care should be exercised as wanted target in sea clutter may be obscured. Note also that in clutter conditions the first few dots of the SART response may not be detectable, irrespective of the setting of the anti-clutter sea control. In this case, the position of the SART may be estimated by measuring 9.5 nm from the furthest dot back towards own ship.

Some sets have automatic/manual anti-clutter sea control facilities in which case the operator should switch to manual.

A/C RAIN control

This should be used normally (to break up areas of rain) when trying to detect a SART response which, being a series of dots, is not affected by the action of the anti-clutter rain circuitry. Note that racon responses, which are often in the form of a long flash, will be affected by the use of this control.

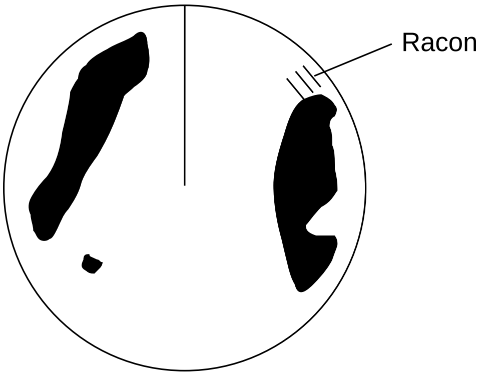
Some sets have automatic/manual anti-clutter rain control facilities in which case the operator should switch to manual.

Note: This SART information is excerpted from IMO SN/Circ 197 Operation of Marine Radar for SART Detection.

2.27.4 Racon (Radar Beacon)

A racon is a radar transponder which emits a characteristic signal when triggered by a ship's radar (usually only the 3 centimeter band). The signal may be emitted on the same frequency as that of the triggering radar, in which case it is superimposed on the ship's radar display automatically.

The racon signal appears on the PPI as a radial line originating at a point just beyond the position of the radar beacon or as a Morse code signal (see figure below) displayed radially from just beyond the beacon.



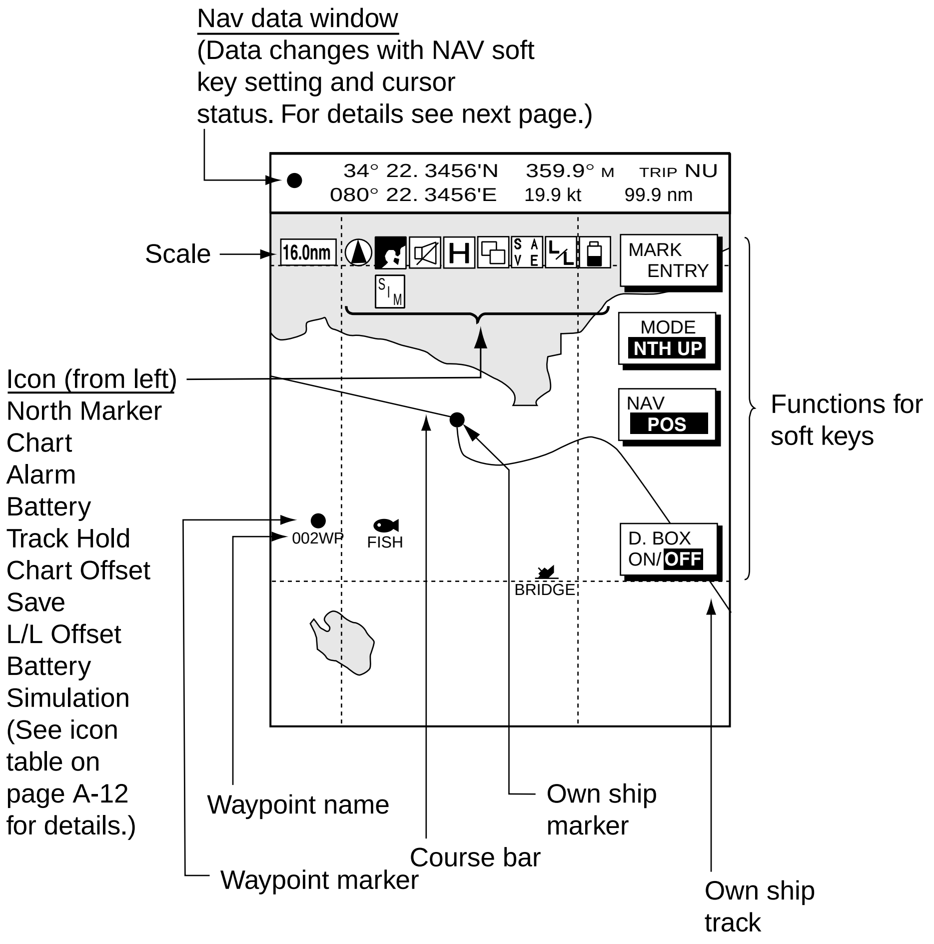
Appearance of racon signal on the radar display

3. PLOTTER OPERATION

3.1 Plotter Displays

You may show the plotter display over the entire screen, or in a combination screen.

3.1.1 Full-screen plotter display

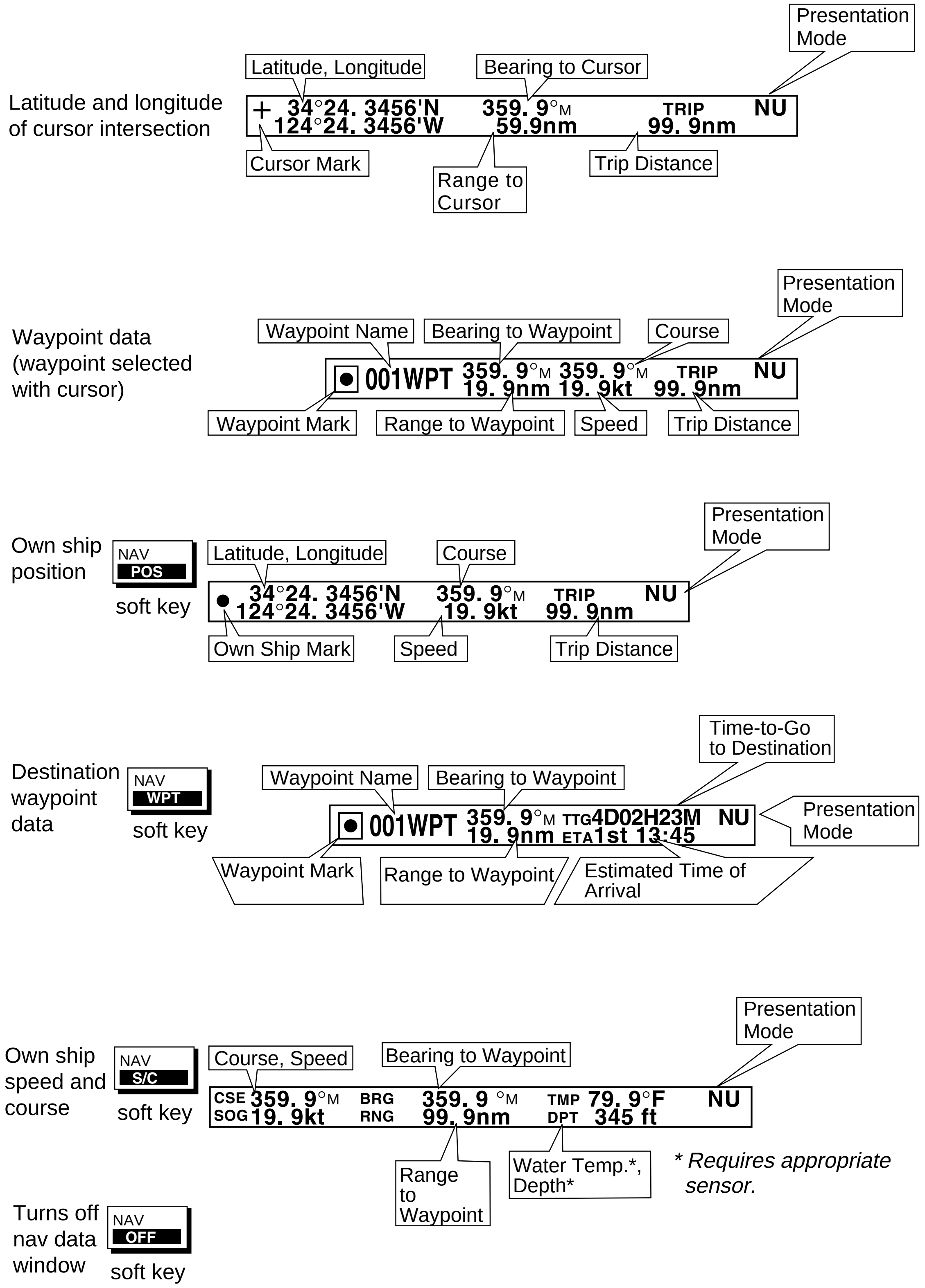


Full-screen plotter display

Note: The own ship marker blinks when the FURUNO GPS Receiver GP-310B loses the GPS signal. For the NavNet display units receiving the GPS signal, the message “No GPS fix!” appears approx. one minute after the signal is lost and is accompanied by the audio alarm. For the NavNet display unit connected to the GP-310B, the visual alarm is released soon after loss and the audio alarm sounds five minutes later.

Nav data window

The data shown in the nav data window depends on the status of the NAV soft key and the cursor.

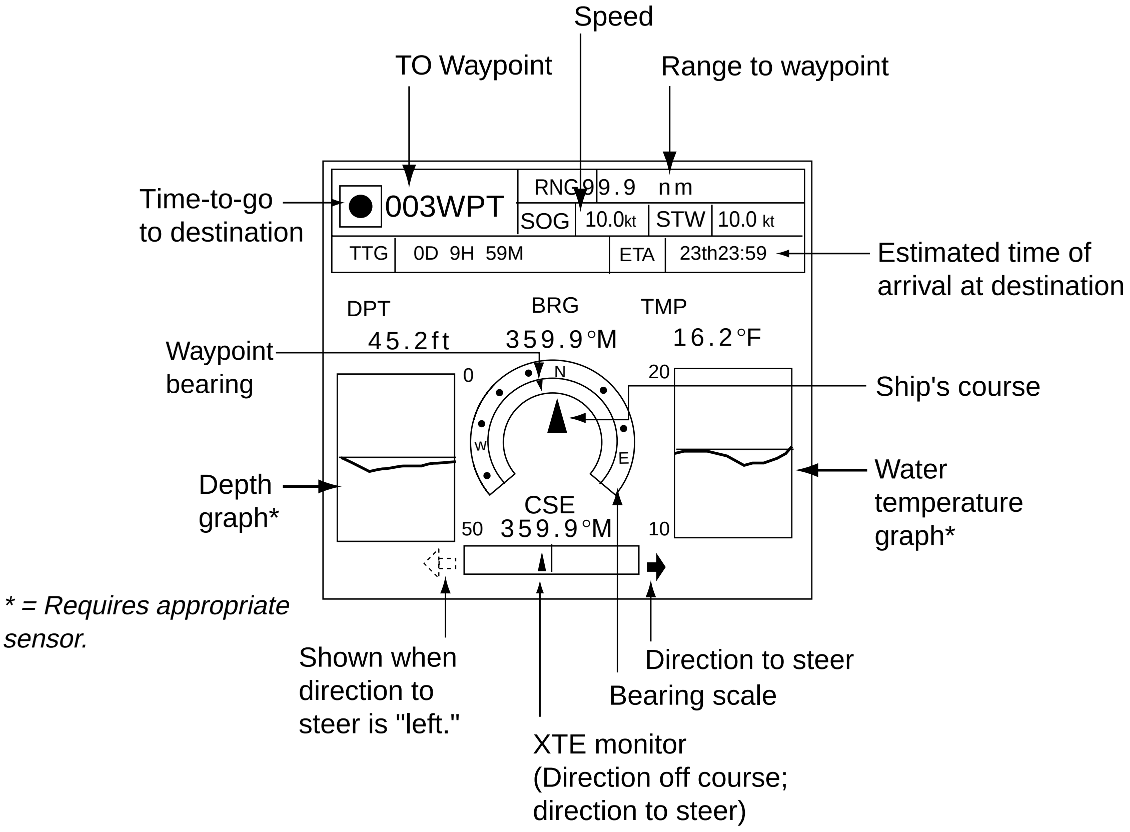


Contents of nav data window

3.1.2 Compass display

The compass display, shown in combination displays, provides steering information. The compass rose shows two triangles: the solid triangle shows own ship's course and the hollow triangle, which moves with course change, shows the bearing to destination waypoint.

The water temperature and depth graphs, which require appropriate sensors, show the latest 10 minutes of water temperature and depth data. The range of the depth graph is 50 feet and it is automatically adjusted with depth.



Compass display

Reading the XTE (cross-track error) monitor

The XTE monitor, located below the compass rose, shows the distance you are off course and the direction to steer to return to course. The own ship marker moves according to direction and distance off course. It flashes when own ship's cross-track error is more than the XTE monitor range. An arrow appears at the left or right side of the XTE scale and it shows the direction to steer. In the example on the previous page you would steer right to return to course. To maintain course, steer the vessel so the own ship marker stays at the center of the XTE monitor.

Soft keys

EDIT XT-LMT: Sets the range for XTE monitor scale. See the procedure below for how to set.
RESET XTE: The RESET XTE enables you to restart navigation, when a destination is set. Press the EDIT XT-LMT soft key followed by the RESET XTE soft key. The following message is displayed.

```
RESTART NAVGATION TO
CURRENT WAYPOINT.
ARE YOU SURE?
YES ... PUSH ENTER KNOB
NO   ... PUSH CLEAR KEY
```

Setting the range for the XTE monitor

1. With the compass (or highway) display shown, press the EDIT XT-LMT soft key to display the following window.

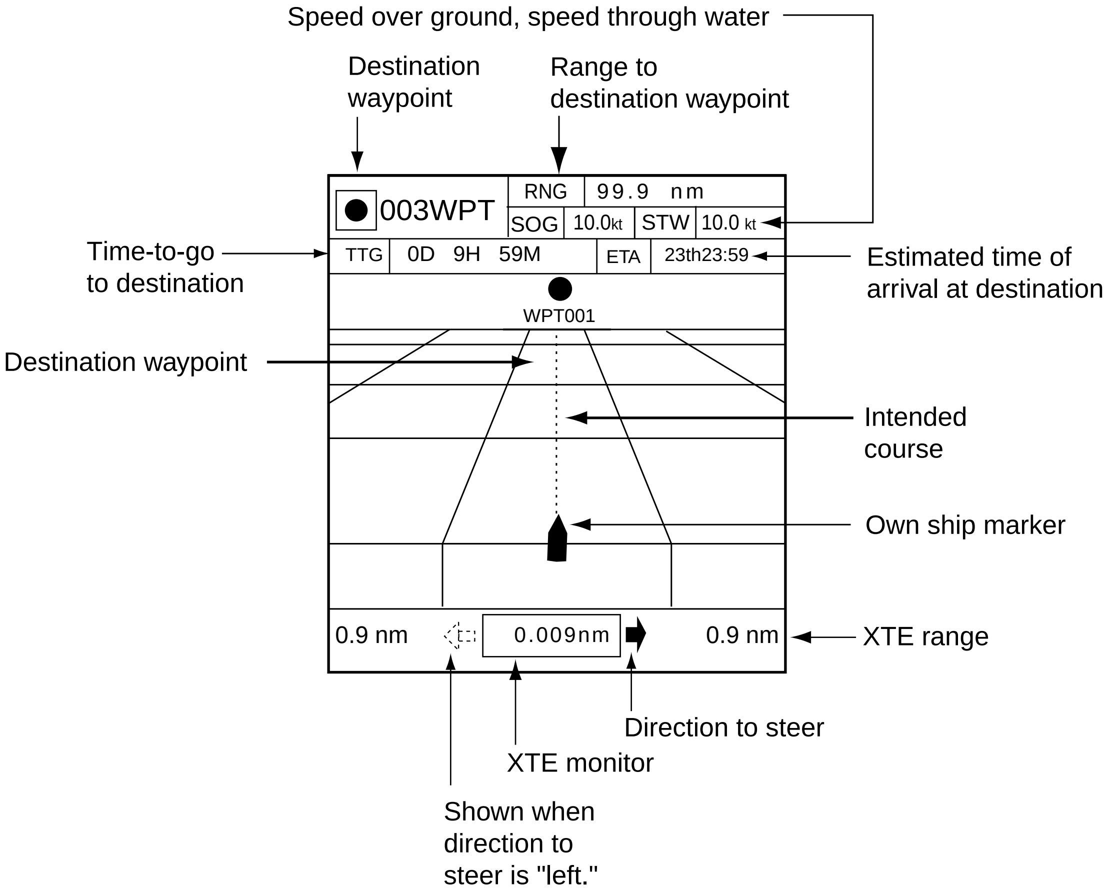
```
XTE LIMIT

0.1nm
```

XTE range setting window

2. Use the trackball to select digit to change. Note that all digits may be cleared by pressing the [CLEAR] key.
3. Rotate the [ENTER] knob to set value, then push it to register setting, or press the CANCEL soft key to cancel.

3.1.3 Highway display

The highway display, shown in the combination displays, provides a graphic presentation of ship's track along intended course. It is useful for monitoring ship's progress toward a waypoint. The own ship marker shows relation between ship and intended course. The XTE monitor shows the direction and amount your vessel is off course – the arrow shows the direction to steer to return to your course and the numeric the distance you are off course. Using the figure below as an example, you would steer right 0.009 nm to return to course. To maintain course, steer the vessel so the own ship marker stays aligned with the intended course line.



Highway display

Soft keys

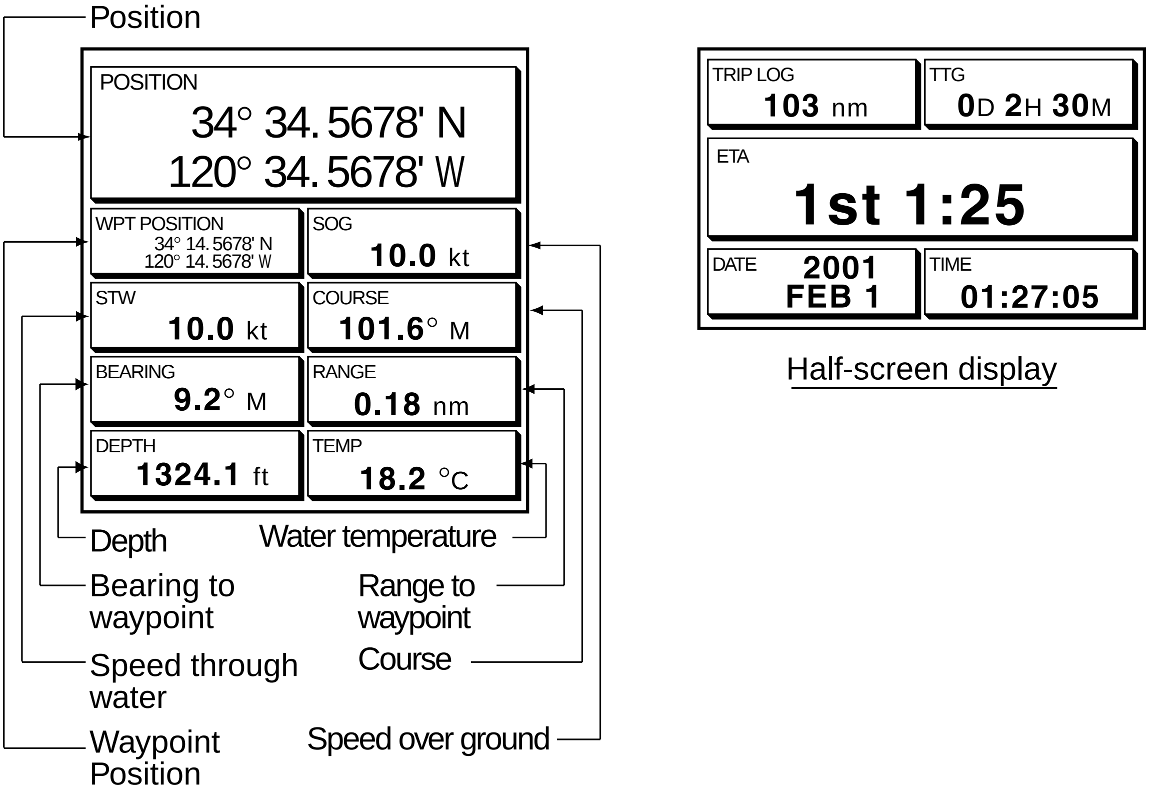
EDIT XT-LMT: Sets the range for XTE monitor scale. See the procedure on the previous page for how to set.

RESET XTE: The RESET XTE enables you to restart navigation, when a destination is set. Press the EDIT XT-LMT soft key followed by the RESET XTE soft key. See the previous page for details.

3.1.4 Nav data display

The nav data display provides comprehensive navigation data, and it can be shown in a full-screen display and a combination display. The user may select what data to display and where to display it. For details see the paragraph "5.8 Nav Data Display Setup."

Appropriate sensors are required. Bars (- -) appear when corresponding sensor is not connected.



Full-screen display

Half-screen display

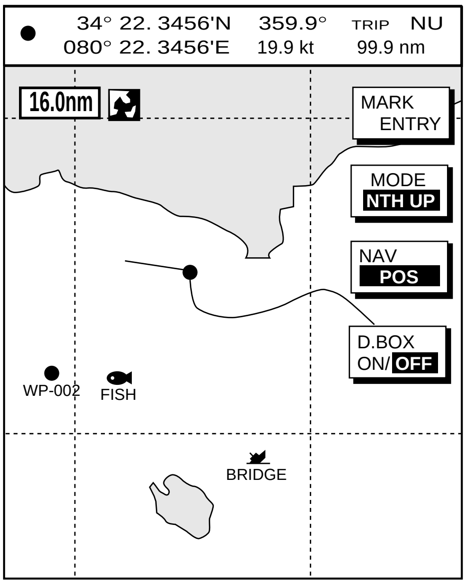
Nav data displays

3.2 Presentation Mode

Three types of presentation modes are provided for the plotter display: north-up, course-up and auto course-up. To change the presentation mode, press the [HIDE/SHOW] key followed by the MODE soft key. Each press of the key changes the presentation mode and presentation mode indication (top right-hand corner of the screen) cyclically in the sequence of North-up, Course-up and Auto course-up.

3.2.1 North-up

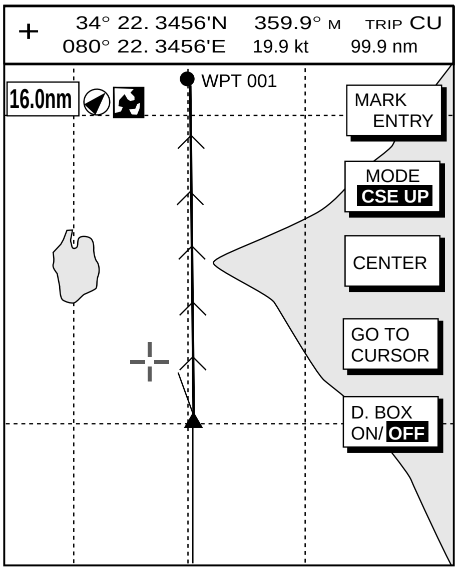
North (zero degree) is at the top of the display and own ship is shown with a filled circle. This mode is useful for long-range navigation.



Plotter display, north-up mode

3.2.2 Course-up

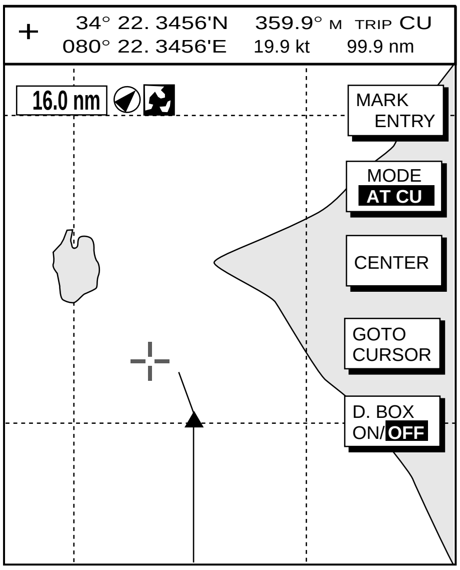
The course-up mode is useful for monitoring ship's progress towards a waypoint. The destination is at the top of the screen when a destination is set. When no destination is set, the course or heading is at the top of the screen at the moment the course-up mode is selected. A filled triangle marks own ship's position. Note that the data sentences GGA and VTG must be output from the NavNet display unit connected to the GPS navigator in order to correctly orient the own ship marker in the course-up mode on other NavNet display units.



Plotter display, course-up mode, destination set

3.2.3 Auto course-up

The course is at the top of screen at the moment the auto course-up mode is selected. In this mode, the current course is kept at the top of the screen within 22.5 degrees. For example, if your vessel turns more than 22.5 degrees to port or starboard, the chart display will rotate so that your course is pointing towards the top of the screen again.



Auto course-up display

3.3 Shifting the Display

The plotter display can be shifted as below.

1. Use the trackball to display the cursor. Locate the cursor at a screen edge. The screen shifts in the direction opposite of cursor location.
2. To turn off the cursor, press the CENTER soft key. This also returns the own ship marker to the screen center.

3.4 Chart Scale

Chart scale (range) may be selected with the [RANGE -] or [RANGE +] key. The [-] key expands the chart range; the [+] key shrinks it. The available ranges are shown as below.

Charts scales

nm	0.125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	1024	2048
km	0.23	0.46	0.93	1.85	3.70	7.41	14.8	29.6	59.3	119	237	474	948	1896	3742
sm	0.144	0.29	0.58	1.15	2.30	4.60	9.21	18.4	36.8	73.7	147	295	589	1178	2356

Note: When the display is expanded or shrunk beyond the range of the chart card in use the message “NO CHART” appears, along with the appropriate chart icon. See the illustration on the next page for details.

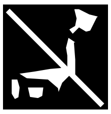
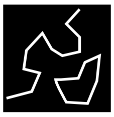
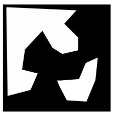
3.5 Chart Cards

3.5.1 Chart card overview

Your plotter uses FURUNO and NavCharts™ (NAVIONICS) charts, or C-MAP charts, depending on the type of display unit you have.

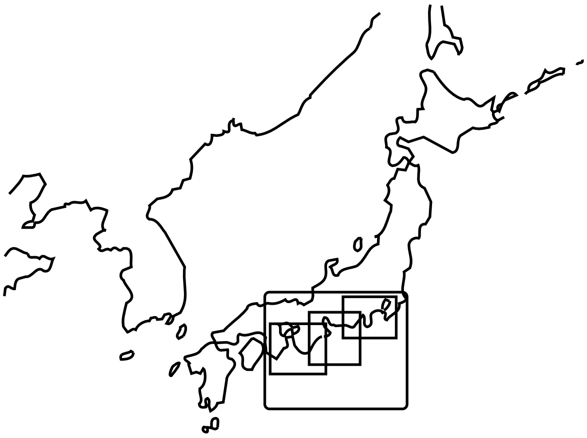
When you insert a suitable chart card in the slot and your boat is any cartographic object, a chart appears. If a wrong card is inserted or a wrong chart scale is selected, landmasses will appear hollow. Chart icons appear at the top of the display to help you select a suitable chart scale. The table below shows the chart icons and their meanings.

Chart icons and their meanings

Icon	Meaning
	Proper card is not inserted or chart scale is too small. Operate the RANGE key to adjust chart scale.
	Chart scale is too large. Operate the RANGE key to adjust chart scale.
	Suitable chart scale is selected.

3.5.2 Indices and chart enlargement

When the [RANGE] key is operated, you will see several frames appear on the chart. These frames are called indices and they show you what parts of the chart can be enlarged in the current range.



Sample chart (Japan), showing indices

When a chart cannot be displayed

A chart will not be displayed in the following conditions:

- When the chart scale is too large or too small.
- When scrolling the chart outside the indices.

When this happens, select proper chart scale.

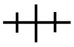
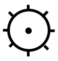
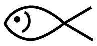
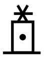
Note: Indices can be turned on or off. For further details, see “Chart border lines” on page 5-12 for FURUNO and NAVIONICS charts and page 5-14 for C-MAP charts.

3.5.3 FURUNO and NavCharts™ charts

Chart symbols

The table below shows FURUNO and NavCharts™ chart symbols and their meanings.

Chart symbols

Symbol	Description	Symbol	Description
	Summit	•	Position of Sounding
	Wreck		Obstruction
	Lighthouse		Fishing Reef
	Lighted Buoy		Platform
	Buoy		Anchorage
	Radio Station		

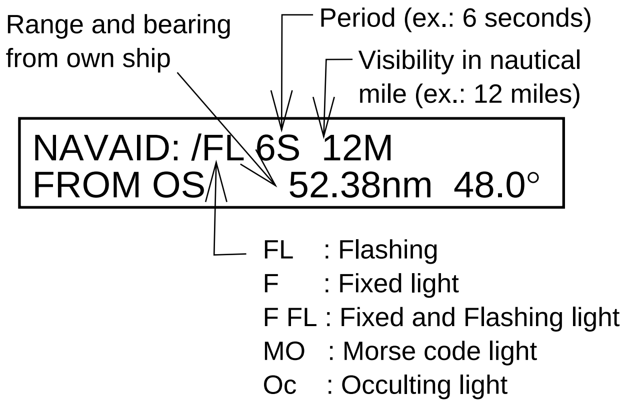
Data for aids to navigation

Selected FURUNO and NavCharts™ charts can show buoy and lighthouse data. Simply place the cursor on the lighthouse or buoy mark.

Place the cursor on
a lighthouse or buoy mark.

Lighthouse mark

Example of data displayed

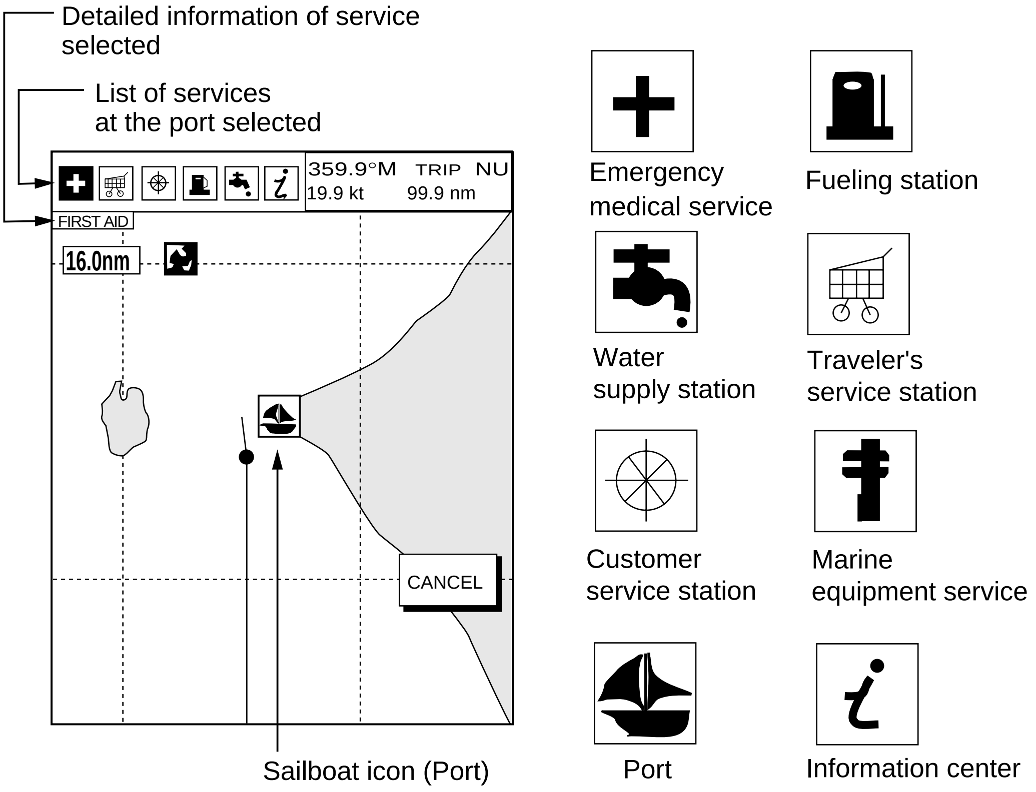


Example of buoy, lighthouse data

Port service icons (NavCharts™ only)

Selected NavCharts show services available at ports, with icons.

1. Use the trackball to place the cursor on the sailboat icon (denotes a port or harbor) desired.
2. Push the [ENTER] knob.
3. Roll the trackball horizontally to select icon desired at the top of the display. The services available appear directly below the icon selected.
4. Press the RETURN soft key to finish.



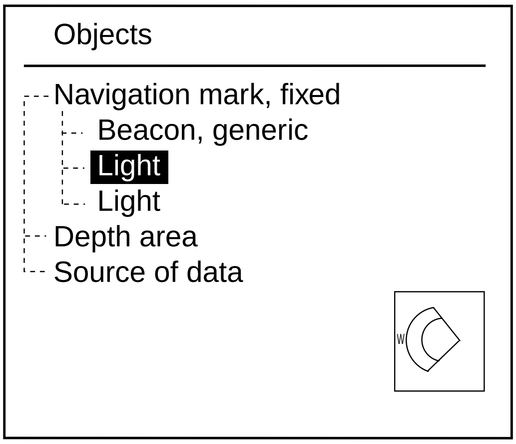
Plotter display, showing port service display

3.5.4 C-MAP charts

Cursor and data display

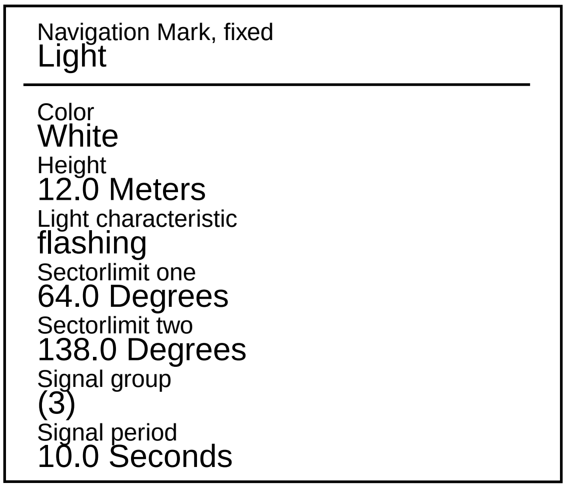
Besides its fundamental functions of providing position data, the cursor can also show information about caution area, depth area, source of data, etc. on C-MAP charts. In addition, you can display information about an icon by placing the cursor on it.

1. Press the trackball to turn the cursor on.
2. Use the trackball to place the cursor on the position desired.
3. Push the [ENTER] knob to open the Objects window.



Objects window

4. Use the trackball to select the item desired.
5. Push the [ENTER] knob to display details for object selected.



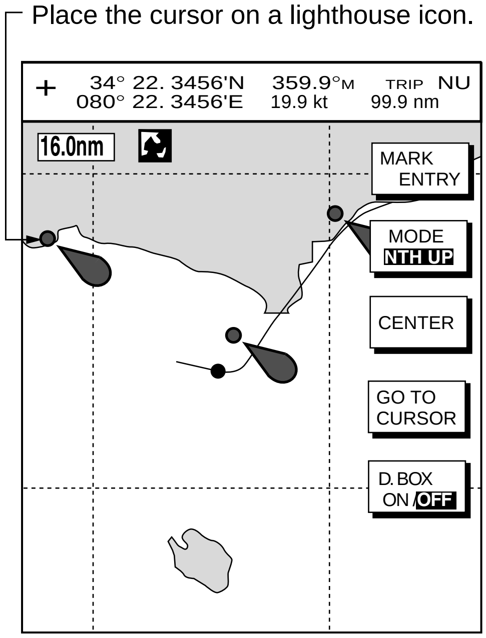
Example of caution area window

6. Press the RETURN soft key to close the window.
7. Press the RETURN soft key.

Icon data

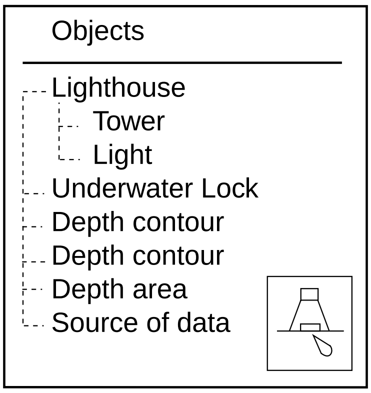
You may place the cursor on any icon to find information about the selected icon.

1. For example, place the cursor on a lighthouse icon.



Lighthouse icon

2. Push the [ENTER] knob to show data. For example, the following window appears for a lighthouse.



Object windows

3. Use the trackball to select the item desired.
4. Push the [ENTER] knob to display detailed information.

Navigation mark, fixed Light.
Color white Height 7. 00 Meters Light characteristic occulting XXXXXXXX XXXXXXXX

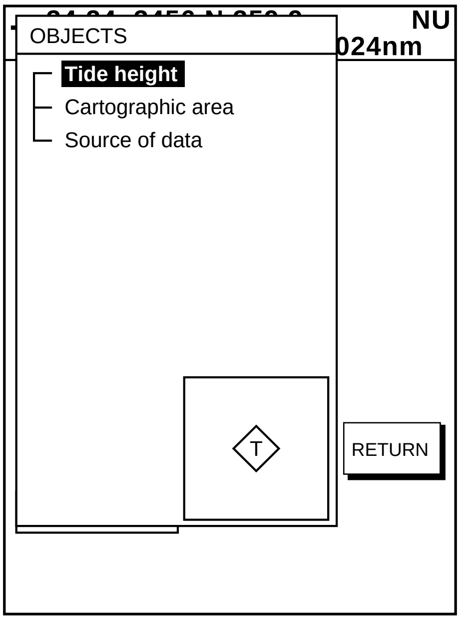
Sample lighthouse data

5. Press the RETURN soft key.

Tide information

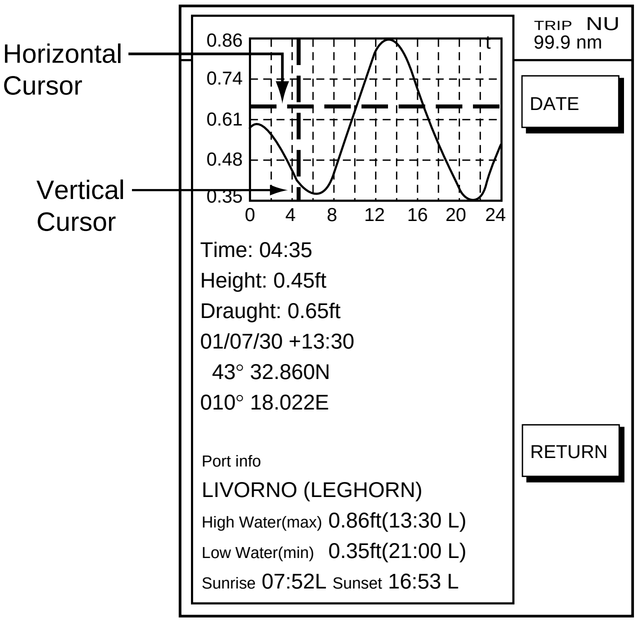
The C-MAP NT chart card provides for calculation of the tide heights for any date. Additionally it displays the times of sunrise and sunset.

1. Press the trackball to place the cursor on a Tide icon (T).
2. Push the [ENTER] knob to open the Objects window.



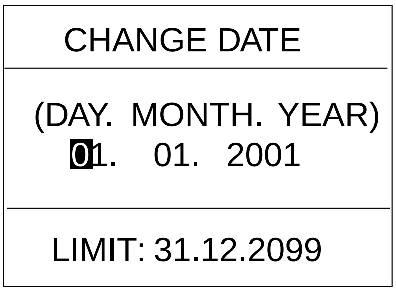
Objects window

3. Use the trackball to select Tide height.
4. Push the [ENTER] knob to open the TIDE window.



Tide window

5. Press the DATE soft key to open the DATE window.



Date window

6. Use the trackball to position the cursor where desired, then rotate the [ENTER] knob to set value. Repeat to enter complete date.
7. Push the [ENTER] knob to show the tidal graph for entered date.
8. Use the trackball to locate the vertical cursor on the hour desired.
9. Use the trackball to shift the level cursor to select draught.
10. See the time, height and draught indications below the tide graph for tide information.
11. Press the RETURN soft key to close the TIDE window.

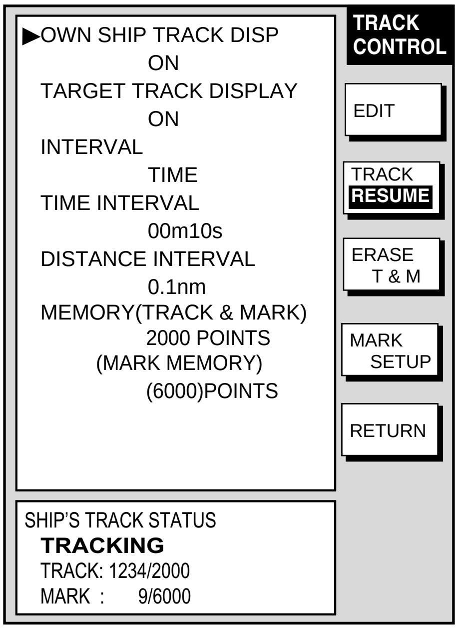
3.6 Working with Track

Your ship's track is plotted on the screen using navigation data fed from position-fixing equipment. This section shows you what you can do with track, from turning it on or off to changing its plotting interval. The own ship's track is turned on in the default setting.

3.6.1 Displaying track

Own ship track

1. Press the [MENU] key followed by the CHART SETUP and TRACKS & MARKS CONTROL soft keys to open the TRACK CONTROL menu.



Track control menu

2. Use the trackball to select OWN SHIP TRACK DISP.
3. Press the EDIT soft key to show the track display window.
4. Use the trackball to select ON (default setting) or OFF as appropriate.
5. Press the ENTER soft key.
6. Press the [MENU] key to close the menu.

Note: The number of track and mark points used appears at the SHIP'S TRACK STATUS window on the TRACK CONTROL menu. Using the figure above as an example, 1234 points of track and 9 marks have been recorded.

Target track

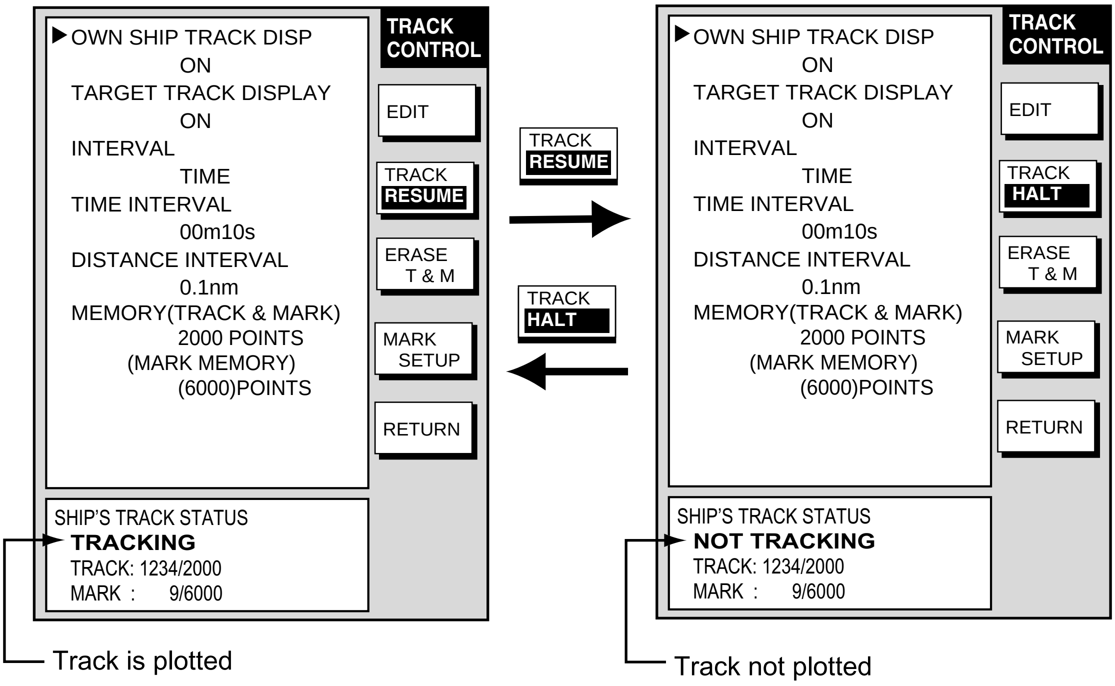
Target track, NMEA format TTM (Tracked Target Message) data sentence, may be turned on or off as desired. The default setting is ON.

1. Press the [MENU] key followed by the CHART SETUP and TRACKS & MARKS CONTROL soft keys to open the TRACK CONTROL menu.
2. Use the trackball to select TARGET TRACK DISPLAY.
3. Press the EDIT soft key to show the target track display window.
4. Use the trackball to select to ON or OFF as appropriate.
5. Press the ENTER soft key.
6. Press the [MENU] key to close the menu.

3.6.2 Stopping, restarting plotting of own ship track

When your boat is at anchor or returning to port you probably won't need to record its track. You can stop recording the track, to conserve the track memory, as follows:

1. Press the [MENU] key followed by the CHART SETUP and TRACKS & MARKS CONTROL soft keys to open the TRACK CONTROL menu.



Track control menu

2. Press the TRACK RESUME soft key. The soft key now shows "TRACK HALT" and the indication "TRACKING" in the SHIP'S TRACK STATUS window changes to "NOT TRACKING." In addition, the icon "H" is displayed at the top of the plotter display and own ship marker becomes a hollow circle. To restart plotting the track, press the TRACK HALT soft key.
3. Press the [MENU] key to close the menu.

3.6.3 Track plotting method and interval for own ship track

In drawing the own ship track, first the ship's position fed from position-fixing equipment is stored into the unit's memory at an interval of time or distance. A shorter interval provides for better reconstruction of the track, but the storage time of the track is reduced. When the track memory becomes full, the oldest track is erased to make room for the latest.

Track plotting method

Track may be plotted by time or distance. The default setting is "time."

1. Press the [MENU] key followed by the CHART SETUP OPTION and TRACKS & MARKS CONTROL soft keys to open the TRACK CONTROL menu.
2. Use the trackball to select INTERVAL.
3. Press the EDIT soft key to display the plot window.

INTERVAL

▲
⊙ TIME
○ DISTANCE
▼

Interval window

4. Use the trackball to select TIME or DISTANCE as appropriate. Distance is useful for conserving track memory, since no track is recorded when the boat is stationary.
5. Press the ENTER soft key.
6. Press the [MENU] key to close the menu.

Track plotting interval

1. Press the [MENU] key followed by the CHART SETUP and TRACKS & MARKS CONTROL soft keys to open the TRACK CONTROL menu.
2. Use the trackball to select TIME INTERVAL or DISTANCE INTERVAL as appropriate.
3. Press the EDIT soft key to display the time or distance interval window, depending on what you selected at step 2.

TIME INTERVAL

00m10s

Setting range: 0 min 1 sec (continuous) - 99 min 59 sec
Default setting: 10 sec

(When selecting TIME INTERVAL.)

DISTANCE INTERVAL

00.10nm

Setting range: 0.01 nm (continuous) - 99.99 nm (km, sm)
Default setting: 0.1 nm

(When selecting DISTANCE INTERVAL.)

Interval windows

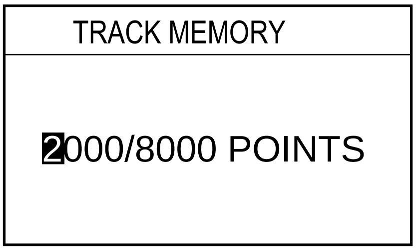
4. Use the trackball to select digit and rotate the [ENTER] knob to set value. The CLEAR soft key functions to clear an entire line of data.
5. Push the [ENTER] knob or ENTER soft key.
6. Press the [MENU] key to close the menu.

3.6.4 Changing own ship track/mark distribution setting

The equipment stores a total of 8000 points of track and marks. This amount may be distributed as desired, and the default setting is 2000 points of track and 6000 marks.

When you change the track memory setting, all tracks and marks in the memory are erased. If necessary save the data to a memory card. For further details see the paragraph “6.1.2 Saving data to a memory card.”

1. Press the [MENU] key followed by the CHART SETUP and TRACKS & MARKS CONTROL soft keys to open the TRACK CONTROL menu.
2. Use the trackball to select MEMORY (TRACK & MARK).
3. Press the EDIT soft key to display the track memory window.



Track memory window

4. Use the trackball to select digit and rotate the [ENTER] knob to set value.
5. Press the ENTER soft key or the [ENTER] knob. You are asked if you are sure to change the track memory capacity.
6. Push the [ENTER] knob.
7. Press the [MENU] key to close the menu.

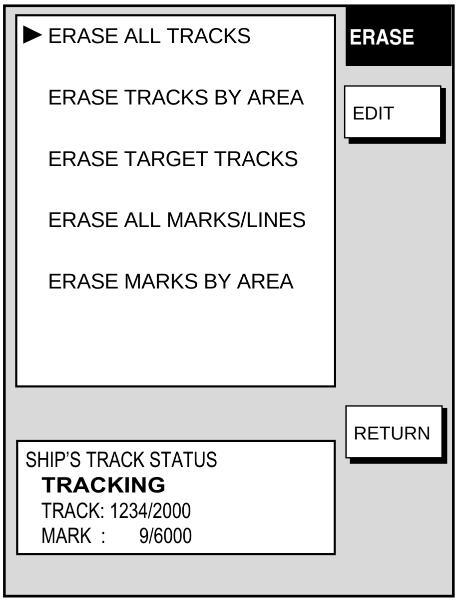
3.6.5 Erasing track

This paragraph shows you how to erase own ship's track and target tracks. You can erase own ship's track collectively and by area.

Erasing own ship track by area

You can erase own ship's track by area as below.

1. Press the [MENU] key followed by the CHART SETUP, TRACKS & MARKS CONTROL and ERASE T & M soft keys to show the ERASE menu.



Erase menu

2. Use the trackball to select ERASE TRACKS BY AREA, then press the EDIT soft key. The menu is erased and the plotter display appears.
3. Use the trackball to place the cursor at the top left-hand corner of the area which you want to erase track from.
4. Push the START soft key or the [ENTER] knob.
5. Move the cursor to the bottom right-hand corner of the area which you want to erase track from.
6. Push the END soft key or the [ENTER] knob. You are asked if you are sure to delete the track.
7. Push the [ENTER] knob to delete the track selected.
8. Press the [MENU] key twice to close the menu.

Erasing all own ship track

1. Press the [MENU] key followed by the CHART SETUP, TRACKS & MARKS CONTROL and ERASE T & M soft keys to show the ERASE menu.
2. Use the trackball to select ERASE ALL TRACKS, then press the EDIT soft key.
3. Push the [ENTER] knob to erase all own ship track.
4. Press the [MENU] key twice to close the menu.

Erasing all target tracks

1. Press the [MENU] key followed by the CHART SETUP, TRACKS & MARKS CONTROL and ERASE T & M soft keys to show the ERASE menu.
2. Use the trackball to select ERASE TARGET TRACKS, then press the EDIT soft key.
3. Push the [ENTER] knob to erase all target tracks.
4. Press the [MENU] key twice to close the menu.

3.7 Marks, Lines

Marks are useful for denoting important points such as a good fishing spot, and can be inscribed in seven shapes.

Mark shapes

3.7.1 Entering a mark, line

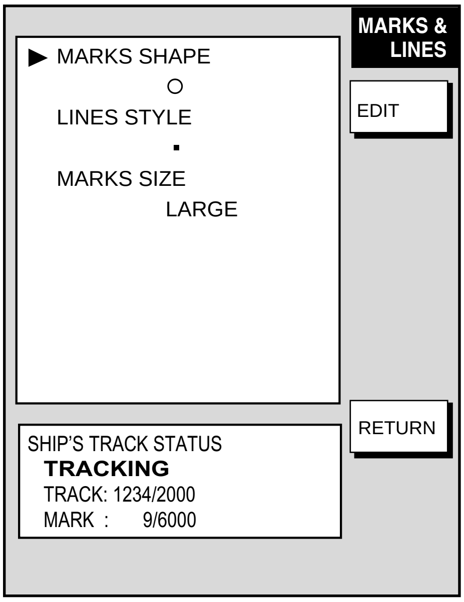
1. Place the cursor where you want a mark to appear.
2. Press the [SHOW/HIDE] key (if necessary) followed by the MARK ENTRY soft key.

The mark is inscribed in the size and shape selected on the MARKS & LINES menu. The default mark attributes are size, large and shape, hollow circle (○).

3.7.2 Changing mark attributes

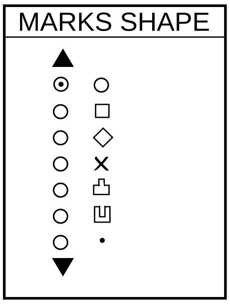
You can select the shape and size for marks on the MARKS & LINES menu.

1. Press the [MENU] key to show the menu.
2. Press the CHART SETUP, TRACKS & MARKS CONTROL and MARK SETUP soft keys to show the MARKS & LINES menu.



Marks & lines menu

3. Select MARKS SHAPE, then press the EDIT soft key.



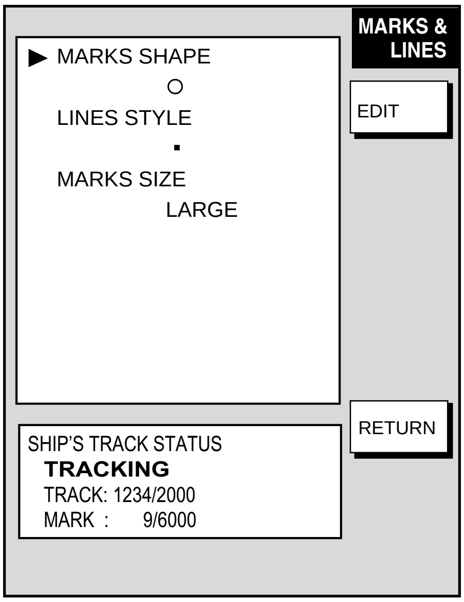
Marks shape window

4. Use the trackball to select mark shape desired, then press the ENTER soft key.
5. Select MARKS SIZE, then press the EDIT soft key.
6. Use the trackball to select LARGE (default setting) or SMALL as appropriate.
7. Press the ENTER soft key.
8. Press the [MENU] key twice to close the menu.

3.7.3 Selecting line type

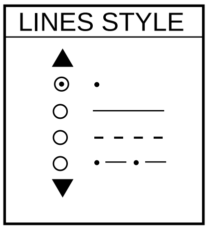
You may inscribe lines to denote good fishing spots, areas of special interest, etc. You can even construct simple charts.

1. Press the [MENU] key followed by the CHART SETUP, TRACKS & MARKS CONTROL and MARK SETUP soft keys to show the MARKS & LINES menu.



Marks & lines menu

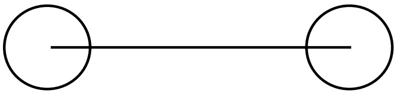
2. Select LINES STYLE, then press the EDIT soft key.



Lines style window

3. Use the trackball to select line style desired, then press the ENTER soft key.

   Line style “dot” disables line drawing. The joint between lines is determined by mark shape. For example, selecting circle as the mark shape will join lines with a circle as below.



4. Press the [MENU] key twice to close the menu.

3.7.4 Erasing marks, lines

Erasing an individual mark

1. Operate the trackball to place the cursor on the mark you want to erase.
2. Press the [CLEAR] key to erase the mark.

Erasing an individual line

Place the cursor on an end of the line to erase, then press the [CLEAR] key. Placing the cursor at the intersecting point of two line segments will erase both line segments.

Erasing marks, lines by area

1. Press the [MENU] key followed by the CHART SETUP, TRACKS & MARKS CONTROL and ERASE T & M soft keys to show the ERASE menu.
2. Use the trackball to select ERASE MARKS BY AREA, then press the EDIT soft key. The menu is erased and the plotter display appears.
3. Use the trackball to place the cursor at the top left-hand corner of the area which you want to erase marks and lines from.
4. Press the START soft key or the [ENTER] knob.
5. Move the cursor to the bottom right-hand corner of the area which you want to erase marks and lines from.
6. Press the END soft key or the [ENTER] knob. You are asked if you are sure to delete the marks/lines selected. Press the [ENTER] knob to delete.
7. Press the [MENU] key twice to close the menu.

Erasing all marks, lines

You can erase all marks and lines collectively. Be absolutely sure you want to erase all marks and lines - erased marks and lines cannot be restored.

1. Press the [MENU] key followed by the CHART SETUP, TRACKS & MARKS CONTROL and ERASE T & M soft keys to show the ERASE menu.
2. Use the trackball to select ERASE ALL MARKS/LINES, then press the EDIT soft key.
3. Push the [ENTER] knob to erase all marks and lines.
4. Press the [MENU] key twice to close the menu.

3.8 Waypoints

In navigation terminology, a waypoint is a particular location on a voyage whether it be a starting, intermediate or destination point. A waypoint is the simplest piece of information your equipment requires to get you to a destination, in the shortest distance possible.

This unit has 999 waypoints into which you can enter position information. You may enter a waypoint five ways: at own ship position, at MOB position (see page 1-15 for details), by cursor, by range and bearing, and through the waypoint list (manual input of latitude and longitude).

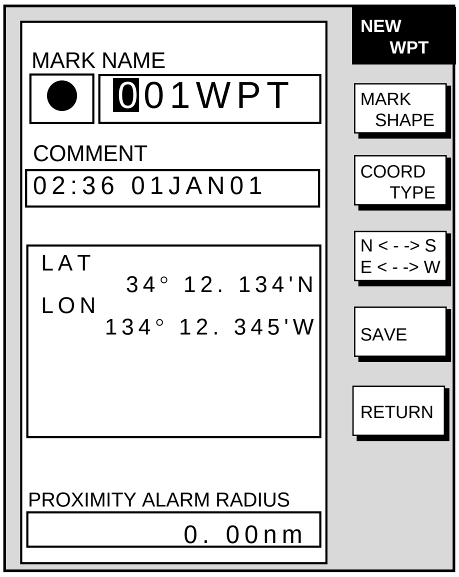
3.8.1 Entering waypoints

Entering a waypoint at own ship position

Press the [SAVE/MOB] key momentarily to store your position as a waypoint. This new waypoint is saved to the waypoint list, under the youngest empty waypoint number.

Entering a waypoint with the cursor

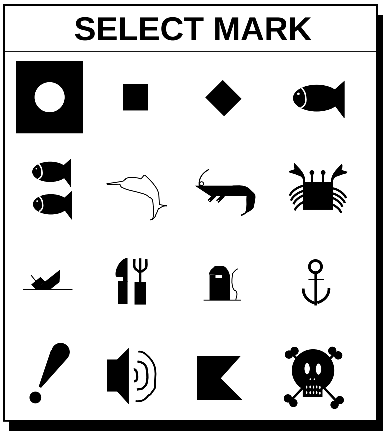
1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES, WAYPOINTS and WAYPOINT BY CURSOR soft keys. The plotter display appears.
3. Operate the trackball to place the cursor where you want to enter a waypoint.
4. Press the NEW WPT soft key. The waypoint window appears and it shows waypoint mark shape, waypoint name, comment (default: date and time), position of waypoint and proximity alarm radius.



Waypoint window

5. **If you do not need to change the waypoint data,** press the SAVE soft key to register the waypoint. The steps which follow show you how to change waypoint data.

6. Press the MARK SHAPE soft key to open the mark shape selection window.



Waypoint ark shape selection window

7. Operate the trackball to select shape desired.
8. Press the ENTER soft key.

   Note: You cannot change the shape and color of a waypoint when the proximity alarm radius for it is other than "zero." To change shape or color, enter all zeroes as the proximity alarm radius.

9. You can change the name (6 characters), comment (13 characters), L/L position and the proximity alarm radius for a waypoint as follows:

   a) Use the trackball to select the NAME, COMMENT, position box or PROXIMITY ALARM RADIUS field. ("Proximity alarm radius" provides for visual and aural alarms when your boat nears a waypoint by the distance specified. The proximity alarm must be turned on in the ALARM menu to use this feature. For details see the paragraph "3.11.6 Proximity alarm.")

   b) Use the trackball to select location.

   c) Rotate the [ENTER] knob to set appropriate alphanumeric character.

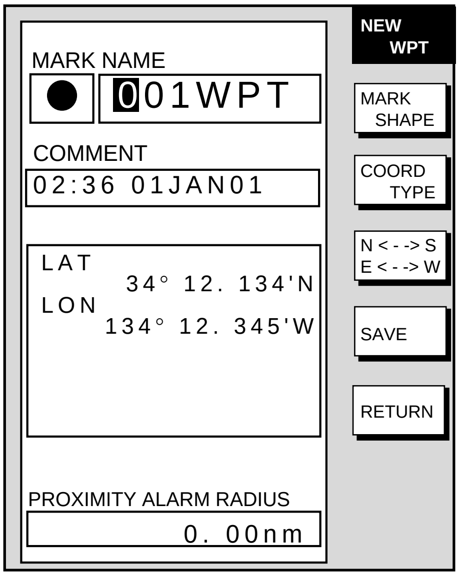
10. Press the SAVE soft key to register the waypoint.
11. Enter another waypoint, or press the [MENU] key to close the menu.

Entering a waypoint by range and bearing

This method is useful when you want to enter a waypoint using range and bearing to a target found on a radar.

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES, WAYPOINTS and WAYPOINT BY RNG & BRG soft keys.
3. An "X" appears at own ship position, and it is the origin point for range and bearing. Operate the trackball to place the cursor on the location desired. Range and bearing from own ship to the cursor appear at the top of the display.

   Note: The origin point of range and bearing can be shifted to the location desired. Operate the trackball to select location, then press the START POINT soft key.
4. Press the NEW WPT soft key. The waypoint window appears and it shows mark shape, waypoint name, comment (default: date and time), position of waypoint and proximity alarm radius.



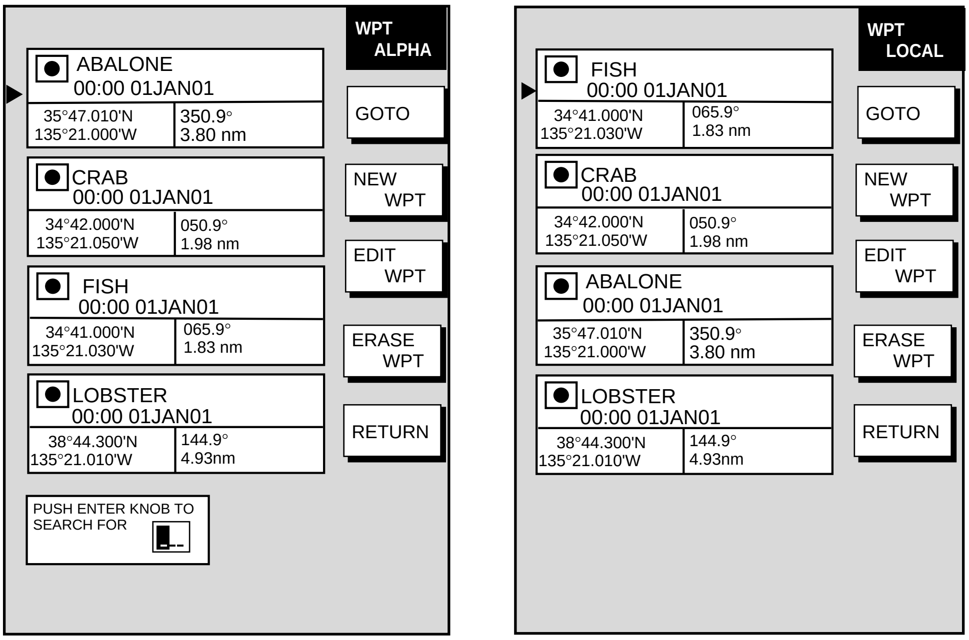
Waypoint window

5. If necessary, change waypoint data following the instructions from step 6 in "Entering a waypoint with the cursor" on page 3-29.
6. Press the SAVE soft key to register the waypoint.
7. Enter another waypoint as above, or press the [MENU] key to finish.

Entering a waypoint from the waypoint list

You can manually enter waypoint position from the waypoint list as follows:

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES and WAYPOINTS soft keys.
3. Press the LOCAL LIST (lists waypoints in order from nearest to furthest) or ALPHANUMERIC LIST (lists waypoints in ALPHANUMERIC order) soft key.



Alphanumeric waypoint list　　Local waypoint list

Alphanumeric and local waypoint lists

4. Press the NEW WPT soft key to show the waypoint window (see the figure on the previous page). Own ship position is shown in the position box.
5. Select the position box and enter position desired.
6. If desired, change waypoint data following the instructions from step 6 in “Entering a waypoint with the cursor” on page 3-29.
7. Press the SAVE soft key to register the waypoint.
8. Press the [MENU] key to close the menu.

3.8.2 Editing waypoint data

Waypoint data may be edited from the waypoint list or directly from the plotter display.

Editing waypoint data from the waypoint list

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES and WAYPOINTS soft keys.
3. Press the LOCAL LIST or ALPHANUMERIC LIST soft key as appropriate.
4. Use the trackball to select the waypoint you want to edit.
5. Press the EDIT WPT soft key.
6. Edit data as appropriate.

7. Press the SAVE soft key.
8. Press the [MENU] key to close the menu.

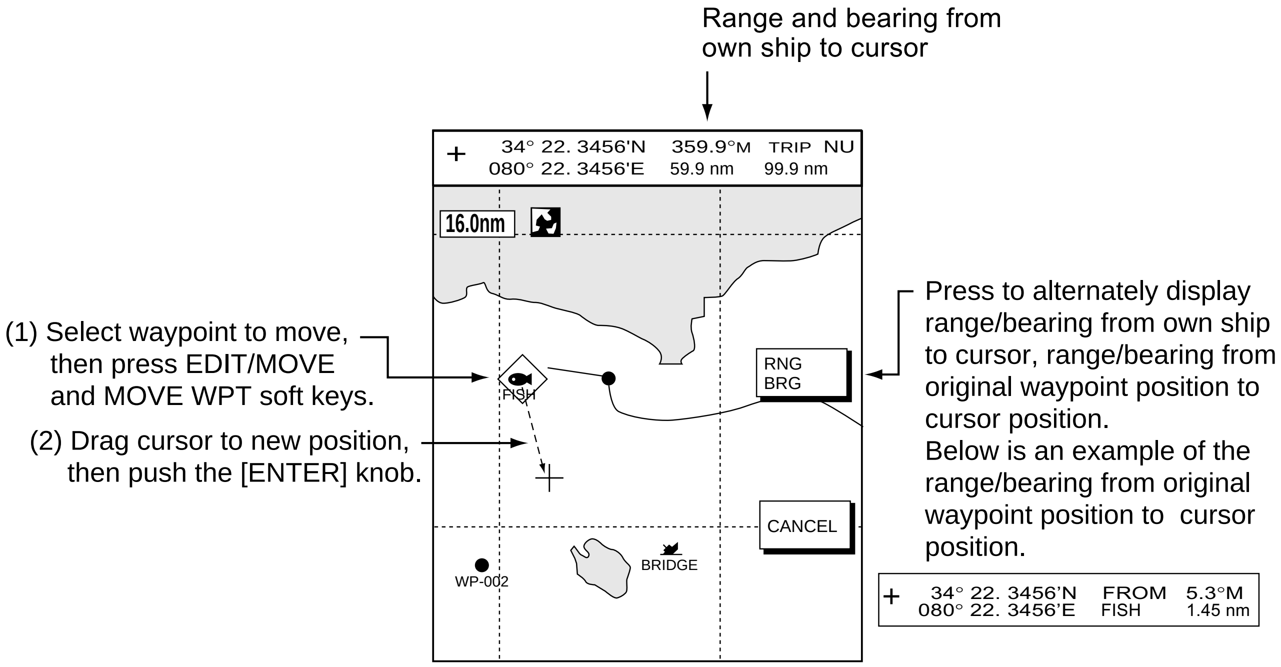
Editing a waypoint from the plotter display

You may edit waypoints from the plotter display as follows:

1. Press the [MENU] key followed by the WAYPOINTS/ROUTES and WAYPOINTS soft key to open the waypoint menu.
2. Press the WAYPOINT BY CURSOR soft key.
3. Operate the trackball to place the cursor on the waypoint which you want to change. A flashing diamond mark appears on the waypoint when it is correctly selected.
4. Press the EDIT/MOVE soft key. Three soft keys replace the EDIT/MOVE soft key:

   EDIT WPT: Edit from the waypoint entry window.
   MOVE WPT: Move waypoint to new position with the cursor.
   ERASE WPT: Erase waypoint. See paragraph 3.8.3.

5. Press appropriate soft key. For the “EDIT WPT,“ the waypoint entry window appears; edit data as appropriate. For “MOVE WPT,” do the following:
   a) Operate the trackball to place the cursor on the location desired for the waypoint. A line connects previous position and new position.
   b) Push the [ENTER] knob. The waypoint moves to the cursor position and its position is changed on the waypoint list. If the waypoint is set as destination or is part of a route, you are asked if you are sure to move the waypoint. In this case, push the [ENTER] knob to move the waypoint, or press the [CLEAR] key to cancel.
   c) Press the [MENU] key to finish.



Plotter display

3.8.3 Erasing waypoints

Erasing a waypoint directly from the plotter display

1. Press the trackball to turn on the cursor.
2. Operate the trackball to place the cursor on the waypoint you want to erase. A flashing diamond mark appears over the waypoint when the waypoint is correctly selected.
3. Press the [CLEAR] key. You are asked if you are sure to erase the waypoint.
4. Push the [ENTER] knob. The waypoint is erased from the plotter screen and the waypoint list.

Erasing a waypoint from the menu

1. Press the [MENU] key followed by the WAYPOINTS/ROUTES and WAYPOINTS soft key to open the waypoint menu.
2. Press the WAYPOINT BY CURSOR soft key.
3. Operate the trackball to place the cursor on the waypoint which you want to erase. A flashing diamond mark appears on the waypoint when it is correctly selected.
4. Press the EDIT/MOVE soft key followed by the ERASE WPT soft key. You are asked if you are sure to erase the waypoint.
5. Push the [ENTER] knob to erase the waypoint.
6. Press the [MENU] key to close the menu. The waypoint is erased from the plotter screen and the waypoint list.

Erasing a waypoint from the waypoint list

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES and WAYPOINTS soft keys.
3. Press the LOCAL LIST or ALPHANUMERIC LIST soft key.
4. Use the trackball to select the waypoint you want to erase.
5. Press the ERASE WPT soft key. You are asked if you are sure to erase the waypoint.
6. Push the [ENTER] knob. The waypoint is erased from both the waypoint list and the plotter screen (if it is currently displayed).
7. Press the [MENU] key to close the menu.

3.8.4 Changing waypoint mark size (FURUNO, NavCharts™)

You may change the size of all waypoint marks to small or large (default), or you may turn them off.

1. Press the [MENU] key to open the menu.
2. Press the CHART SETUP and CHART DETAILS soft keys.

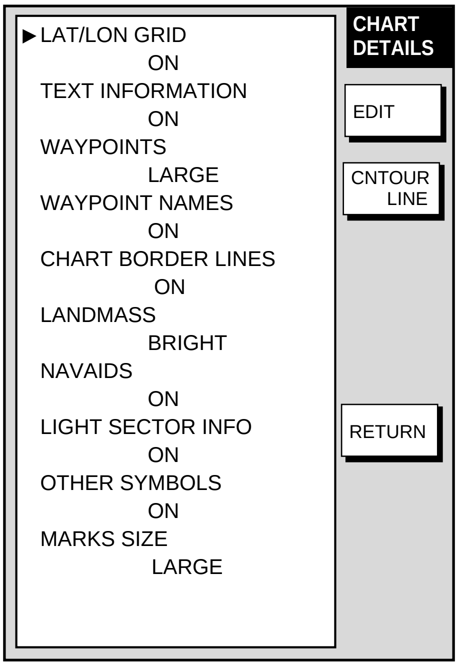


Chart details menu

3. Use the trackball to select WAYPOINTS.
4. Press the EDIT soft key.
5. Use the trackball to select LARGE, SMALL or OFF.

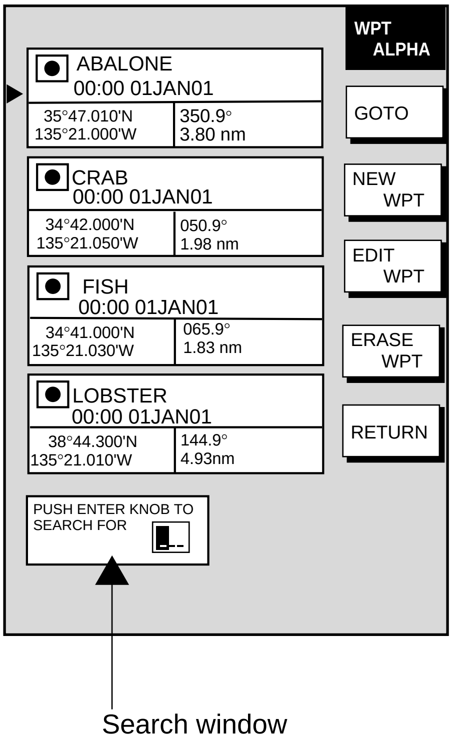
   LARGE: Shows mark in actual shape.
   SMALL: Displays all waypoints with an “X” regardless of mark shape selected.
   OFF: Turns off all waypoints and their names. Waypoints currently used in navigation are shown regardless of this setting.

6. Press the ENTER soft key.
7. Press the [MENU] key to close the menu.

3.8.5 Searching waypoints

You can search for a waypoint through the alphanumeric waypoint list as follows:

1. Press the [MENU] key.
2. Press the WAYPOINTS/ROUTES, WAYPOINTS and ALPHANUMERIC LIST soft keys to show the alphanumeric list.



Alphanumeric list

3. Use the trackball and the [ENTER] knob to enter up to three alphanumeric characters in the search window. Adjust the trackball horizontally to select location. Then, the waypoint searched appears at the top of the screen.
4. Press the [MENU] key to close the menu.

3.9 Routes

Often a trip from one place to another involves several course changes, requiring a series of route points (waypoints) which you navigate to, one after another. The sequence of waypoints leading to the ultimate destination is called a route. Your unit can automatically advance to the next waypoint on a route, so you do not have to change the destination waypoint repeatedly.

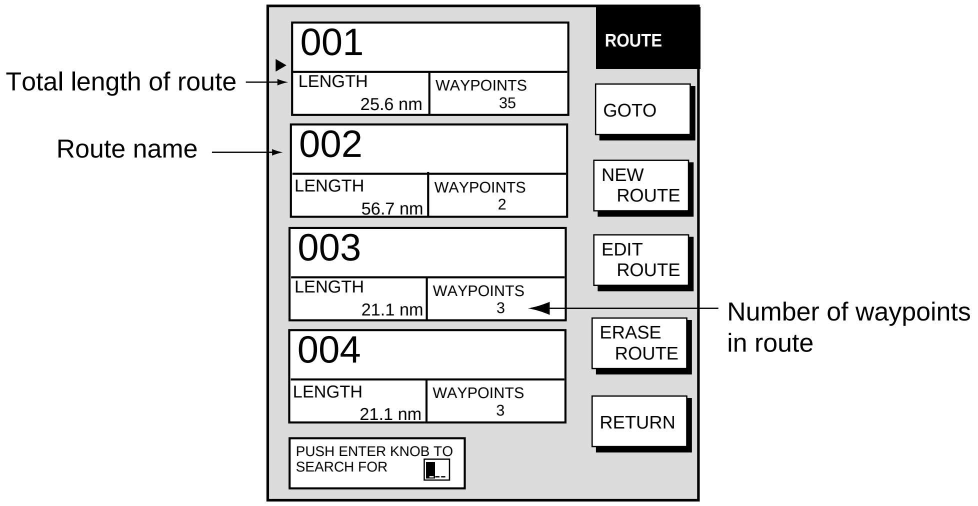
You can store up to 200 routes, and a route may have 35 waypoints.

3.9.1 Creating routes

Entering a route with existing waypoints

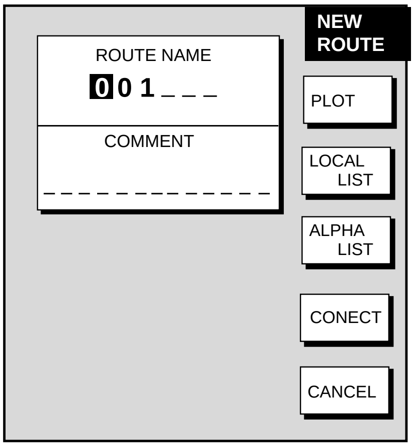
This method constructs routes by using existing waypoints.

1. Press the [MENU] key.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the ROUTES soft key to open the ROUTE menu. (No data will be shown if there are no routes entered.)



Route menu

4. Press the NEW ROUTE soft key to open the new route entry screen.



New route entry screen

5. If desired you can change the route name shown and/or add a comment. A route name may consist of six characters; comment, 13 characters.
6. Press the LOCAL LIST or ALPHA LIST soft key to open the waypoint list.
7. Use the trackball to select a waypoint, then press the ADD WPT soft key to add it to the route.
8. Repeat step 7 to complete the route.

   Note: To clear last-entered waypoint, press the ERASE LST WP soft key. Each press of this key deletes the last waypoint entered.

9. Press the SAVE soft key to register the route.
10. Press the [MENU] key to close the menu.

Entering a route with the cursor

This method allows you to construct a route directly from the plotter display, using existing waypoints or new positions. Any new position will be saved as a waypoint, under the youngest empty waypoint number.

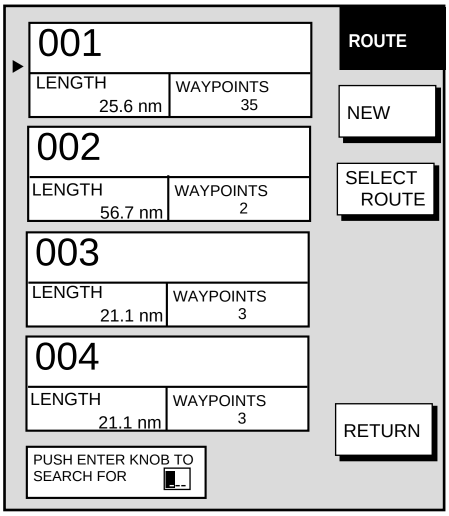
1. Follow steps 1-5 in “Entering a route from the route list” on the previous page.
2. Press the PLOT soft key to show the plotter display.
3. Operate the trackball to place the cursor on an existing waypoint (ADD WP soft key appears) or new location (ADD NEW WP soft key appears).
4. Press the ADD WP soft key (or ADD NEW WP soft key).
5. Repeat steps 3 and 4 to complete the route.
6. Push the [ENTER] knob to register the route.

Creating voyage-based routes

You can create routes based on your ship's track. The route can be created automatically by time or distance, or manually. This feature is useful when you wish to retrace previous track.

The "SAVE" icon (SAVE) appears at the top of the screen when a voyage-based route is being created.

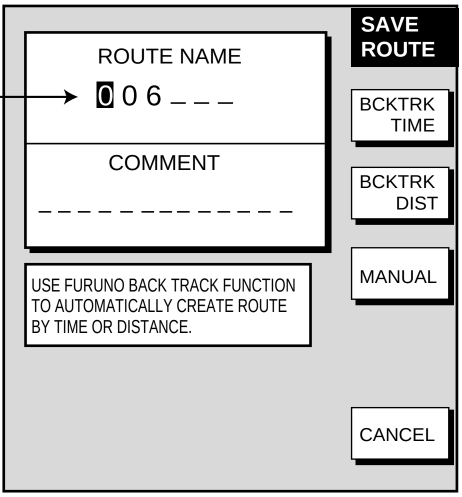
1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the CREATE VOYAGE-BASED ROUTE soft key.



Save route menu

4. Press the NEW soft key to show the new route window.

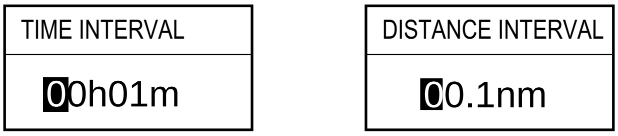
   Note: If you want to tack voyage-based points onto the end of an existing route, select the route desired, then press the SELECT ROUTE soft key instead of the NEW soft key.



Save route window

5. If required, you may change the route name and enter a comment.

6. Choose how to record points for your route, by time, by range or manual entry, by pressing BCKTRK TIME, BCKTRK RANGE or MANUAL soft key as appropriate. For manual entry, go to step 8. For BCKTRK TIME, BCKTRK DIST one of the following displays appears.



(When selecting BCKTRK TIME.) (When selecting BCKTRK DIST.)

Displays for entry of time, distance interval

7. Use the trackball to select digit; rotate the [ENTER] knob to set value. Press the START LOG and RETURN soft keys followed by the [MENU] key to close the menu. At this moment, a voyage-based route will be created.
8. **For manual entry of waypoints, do the following:**
   a) Press the [SAVE/MOB] key momentarily to enter a waypoint mark at own ship position. A new waypoint is created under the youngest empty waypoint number and added to the route. (At this time you may close the SAVE ROUTE screen by pressing the RETURN soft key followed by the [MENU] key.)
   b) Repeat step a) as necessary. 35 waypoints may be entered.

<u>*To stop recording waypoints and save the route*</u>

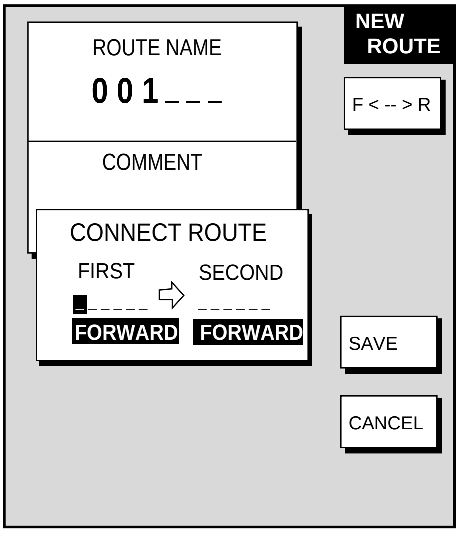
You can stop recording waypoints and save the route as shown in the procedure below. When 35 waypoints have been entered the message “Total 35 WPTS have been already registered in the route. Stop creating voyage-based route.” is displayed. In this case, save the route as shown below.

1. Press the [MENU] key followed by the WAYPOINTS/ROUTES and CREATE VOYAGE-BASED ROUTE soft keys.
2. Press the FINISH LOG soft key to stop recording waypoints and save the route.
3. Press the [MENU] key to close the menu.

3.9.2 Connecting routes

Two routes which you have created can be connected as follows to form a new route.

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the ROUTES soft key.
4. Press the NEW ROUTE soft key.
5. If desired enter route name and comment.
6. Press the CONECT soft key.
7. Use the trackball and the [ENTER] knob to enter the route name for the first route, beneath FIRST in the connect route window.



Connect route window

8. Press the F<– –>R soft key to select direction to follow the waypoints of the route, forward or reverse.
9. Enter the route name of the second route as you did for the first route.
10. Press the SAVE soft key.
11. Press the [MENU] key to close the menu.

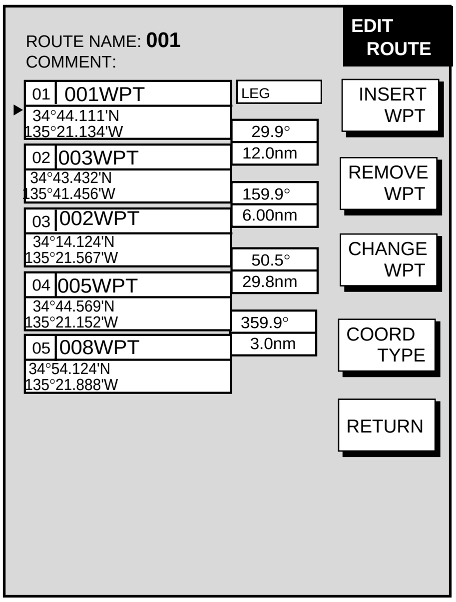
Note: The maximum number of waypoints in a route is 35. If this number is exceeded an error message appears. In this case, delete waypoints in one or both routes so the total number of waypoints does not exceed 35.

3.9.3 Inserting a waypoint in a route

Waypoints can be inserted in a route as follows:

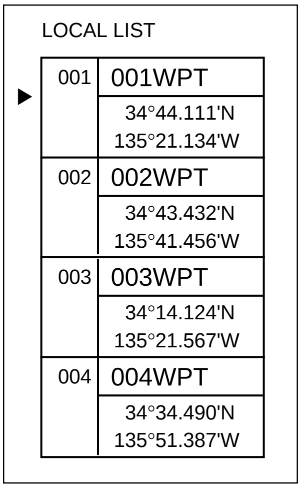
Inserting a waypoint from the route list

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the ROUTES soft key.
4. Use the trackball to select a route.
5. Press the EDIT ROUTE soft key. The route name screen appears.
6. Press the LOCAL LIST soft key.



Edit route menu

7. Use the trackball to place the cursor at the location where you want to insert a waypoint.
8. Press the INSERT WPT or CHANGE WPT soft key as appropriate. The local waypoint list appears.



Waypoint list for editing a route (local list)

9. Use the trackball to select the waypoint you want to insert. (You can switch between the local list and alphanumeric list by using the LOCAL LIST and ALPHA LIST soft keys.)
10. Press the SELECT WPT or CHANGE WPT soft key, whichever is displayed.
11. Press the [MENU] key to close the menu.

Inserting a waypoint from the plotter display

Inserting a waypoint before first waypoint or after last waypoint in a route

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the ROUTES soft key.
4. Use the trackball to select a route.
5. Press the EDIT ROUTE soft key.
6. Press the PLOT soft key to show the plotter screen.
7. Operate the cursor to place the cursor on the first (or last) waypoint of the route. A flashing diamond appears over the waypoint when it is correctly selected.
8. Press the ADD TO START soft key or the ADD TO END soft key depending on the waypoint you selected at step 7.
9. Operate the trackball to place the cursor on an existing waypoint (ADD WPT soft key appears) or new location (ADD NEW WP soft key appears).
10. Press the ADD WPT soft key (ADD NEW WP soft key).
11. Press the [MENU] key to close the menu.

Inserting a waypoint in an intermediate location on a route

1. Follow steps 1 through 6 in “Inserting a waypoint before the first or last waypoint in a route.”
2. Operate the trackball to place the cursor on a line connecting waypoints. The SPLIT LEG soft key appears and the line flashes when it is correctly selected.
3. Press the SPLIT LEG soft key.
4. Move the cursor to a new location or select an existing waypoint, in which case the INSERT NEW WP soft key replaces the INSERT WPT soft key.
5. Press the INSERT WPT soft key (INSERT NEW WP soft key).
6. Press the [MENU] key to close the menu.

3.9.4 Removing waypoints from a route

Removing a waypoint from the route list

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the ROUTES soft key.
4. Select a route.
5. Press the EDIT ROUTE and LOCAL LIST soft keys.
6. Select the waypoint you want to remove.
7. Press the REMOVE WPT soft key.
8. Press the [MENU] key to close the menu.

Removing a waypoint from the plotter display

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the ROUTES soft key.
4. Select a route.
5. Press the EDIT ROUTE soft key.
6. Press the PLOT soft key to show the plot screen.
7. Operate the trackball to place the cursor on the waypoint you want to remove from the route.
8. Press the REMOVE WPT soft key. The route is redrawn, eliminating the waypoint removed.
9. Press the [MENU] key to close the menu.

3.9.5 Erasing routes

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the ROUTES soft key.
4. Use the trackball to select a route.
5. Press the ERASE ROUTE soft key. You are asked if you are sure to erase the route.
6. Push the [ENTER] knob to erase the route, or the [CLEAR] key to escape.
7. Press the [MENU] key to close the menu.

3.10 Navigation

This section shows you how to get to a desired destination by “quick points,” waypoints, port services and routes.

Note: Reciprocal setting and canceling of destination is available by outputting the data sentence ZDA from the NavNet unit connected to the navigator.

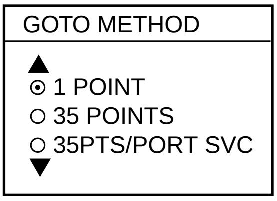
3.10.1 Navigating to a “quick point”

The “quick point” feature allows you to navigate to point(s) without retaining the data indefinitely in your unit’s memory.

Selecting quick point entry method

You need to tell your unit how to set the quick point: 1 POINT, 35 POINTS (up to 35 points) or 35PTS/PORT SVC. (For how to navigate to points/port services see “3.10.3 Navigating to ports, port services” on page 3-46.)

1. Press the [MENU] key.
2. Press the PLOTTER SETUP soft key.
3. Use the trackball to select SET GOTO METHOD, then press the EDIT soft key.



Go to method window

4. Use the trackball to select a method.
5. Press the ENTER soft key.
6. Press the [MENU] key to close the menu.

Navigating to a single quick point

1. Select “1 POINT” following the procedure in the above paragraph.
2. Place the cursor on an existing waypoint (GOTO WPT soft key appears) or a new location (GOTO CURSOR soft key appears).
3. Depending on the selection you made at step 1, press the GOTO CURSOR or GOTO WPT soft key.

A line with arrows connects between own ship and destination, which is marked as “<QP01>” for cursor-selected waypoint or waypoint name in case of waypoint. This line shows the shortest course to the destination. Arrows on the line show the direction to follow to get to the quick point. Range and bearing from own ship to the destination appear at the top of screen. The quick point location is saved to the waypoint list as waypoint “QP01.”

Navigating to multiple quick points

1. Select “35 POINTS” following the procedure in “Selecting quick point entry method” on the previous page.
2. Press the GOTO soft key.
3. Place the cursor on an existing waypoint (SELECT WPT soft key appears) or a new location (ADD QP soft key appears).
4. Depending on the action taken at step 3, press the SELECT WPT or ADD QP soft key. “QP<01>” appears at the cursor location if a quick point is selected. To erase last-entered quick point (waypoint), press the ERASE LST QP (ERASE LST WP) soft key.
5. Repeat steps 3 and 4 to complete the route.
6. Push the [ENTER] knob to finish.

A line with arrows connects between own ship and all points. Arrows on the line show the direction to follow to get to your destination. Quick points are numbered in sequential order from QP<01> and are saved to the waypoint list. Range and bearing from own ship to the first destination appear at the top of screen. The quick points are saved as a route, under the name “Q>RTE” (Quick Route).

3.10.2 Navigating to waypoints

Selecting a waypoint from the plotter display

1. Operate the trackball to select a waypoint.
2. Press the GOTO WPT soft key.

Note: GOTO method should be selected to “1 POINT” on the PLOTTER SETUP menu.

Selecting a waypoint from the waypoint list

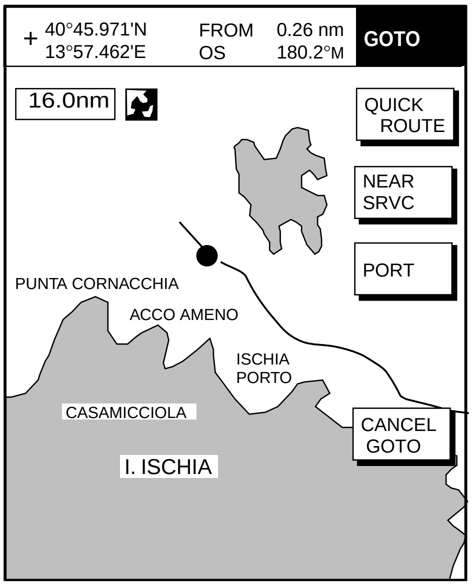
1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the WAYPOINTS soft key to open the waypoint menu.
4. Press the LOCAL LIST or ALPHANUMERIC LIST soft key as desired.
5. Use the trackball to select a waypoint.
6. Press the GOTO soft key, and the plotter display appears.

For either of the above methods, a line with arrows runs between waypoint selected and own ship’s position. Arrows on the line show the direction to the follow to get to the waypoint. Waypoint data appears at the top of screen.

3.10.3 Navigating to ports, port services (NavCharts™ only)

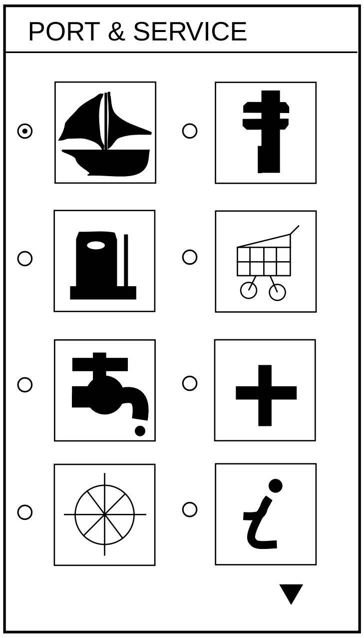
NavCharts™ have a port service list which shows services available at ports or harbors. (See page 3-13.) You can use the list to set your destination as follows:

1. Select "35 PTS/PORT SVC" following the procedure in "Selecting quick point entry method" on page 3-44.
2. Place the cursor on location desired, then press the GOTO soft key. Soft key titles change as in the figure below.

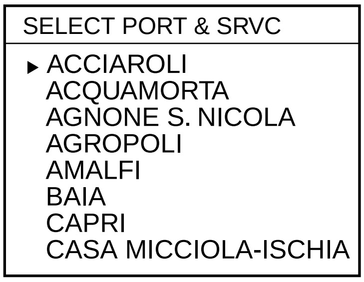


Plotter display

3. Press the PORT or NEAR SRVC soft key depending on objective. PORT shows a list of ports in your area. NEAR SRVC displays the port service list.



Port services

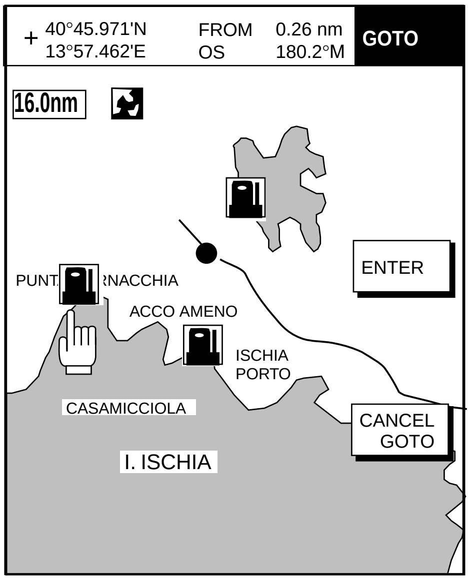


Port list (Italy)

Port services and sample port list

4. **If you selected PORT at step 3,** use the trackball to select a port, then press the ENTER soft key. Make a route using the soft keys, then push the [ENTER] knob. (If you want to go directly to that port, simply press the ADD QP soft key followed by the [ENTER] knob.)

   If you selected NEAR SRVC at step 3, select service mark desired with the trackball, then press the ENTER soft key or the [ENTER] knob. Then, the display shows the locations of those services nearest you. (The figure below shows the location of filling stations in an area in southern Italy.) Use the trackball to place the "hand cursor" on the port service icon desired, then press the ENTER soft key. Make a route using the soft keys, then push the [ENTER] knob. (If you want to go directly to location selected, simply press the ADD QP soft key followed by the [ENTER] knob.)

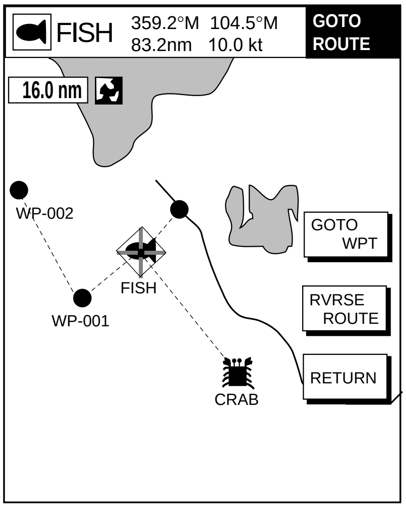


Sample filling station locations (southern Italy)

3.10.4 Following a route

Selecting the route to follow

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the ROUTES soft key to open the route list.
4. Select a route.
5. Press the GOTO soft key to show the plotter display. The cursor is on the waypoint nearest own ship.



Plotter display, route selected as destination

6. Operate the trackball to place the cursor on the waypoint or leg in the route from where to start navigating the route.
7. Press the GOTO WPT or FOLLOW LEG soft key, depending on the action taken at step 6.

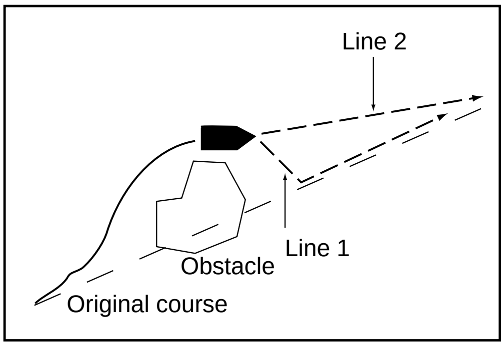
A line connects between own ship and all waypoints. The arrows on the lines show the direction to traverse the route.

Navigating waypoints in reverse order

Press the RVRSE ROUTE soft key followed by the [ENTER] knob to navigate waypoints in reverse order. The arrows on the route line point in the direction selected.

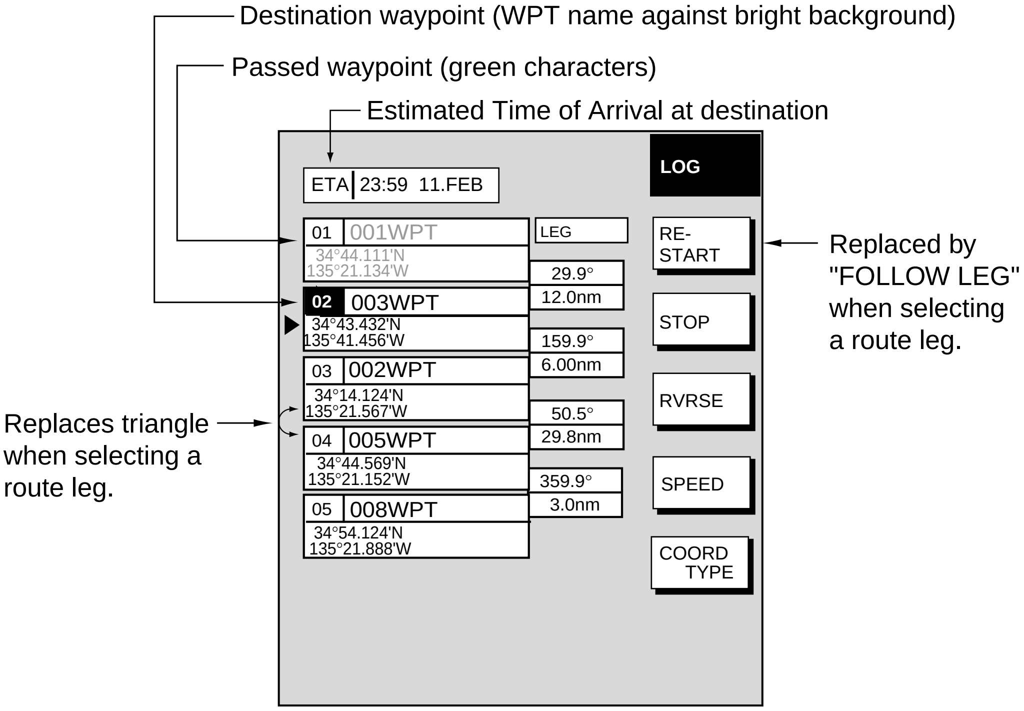
Restarting navigation

When you steer to avoid an obstacle or the vessel drifts, you may go off your intended course, as in Line 1 in the figure below. Also, if you don’t need to return to the original course, you can go directly to the next waypoint, as in Line 2 in the figure below. In these cases, use the restart navigation function to restart navigation.



Example of when to restart navigation

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the LOG soft key.



Log display

4. Use the trackball to select a waypoint or a route leg. When a route leg is selected the single arrow cursor is replaced by double arrows.
5. Press the RESTART soft key, or FOLLOW LEG in case of route leg.

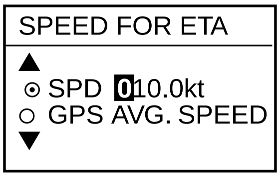
Note: Navigation may be restarted from the plotter display, with the RESTART key, when a single quick point (QP<01>) is selected for navigation.

6. Press the [MENU] key to close the menu.

Setting speed for ETA calculation

Speed, which may be input manually or automatically, is required to calculate ETA (Estimated Time of Arrival) to a destination.

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the LOG soft key.
4. Press the SPEED soft key.



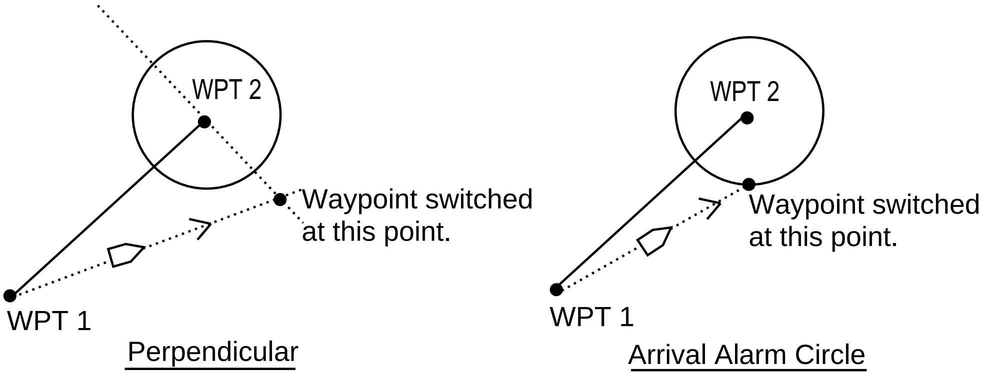
Select speed for ETA window

5. Enter speed manually in the SPD, or use GPS speed data (if applicable) by selecting GPS AVG. SPEED.
6. Press the ENTER soft key or the [ENTER] knob to register your selection.
7. Press the [MENU] key to close the menu.

Switching waypoints

When you arrive to a waypoint on a route, you can switch to the next waypoint by one of three methods below.

PERPENDICULAR: Automatically switches the destination waypoint when the boat passes an imaginary perpendicular line passing through the center of the destination waypoint.
ARRVL ALM CRCL: Destination waypoint is automatically switched when the boat comes within the arrival alarm range. For how to set the arrival alarm, see the paragraph 3.11.2 Arrival alarm.
MANUAL: The destination waypoint may be manually switched by using the RESTART soft key (see page 3-49). This function is operative when “1 POINT” is selected as the GOTO method (see page 3-44).



Automatic waypoint switching methods

To select waypoint switching method do the following:

1. Press the [MENU] key.
2. Press the PLOTTER SETUP soft key.
3. Use the trackball to select WAYPOINT SWITCHING.
4. Press the EDIT soft key to show the waypoint switching window.
5. Use the trackball to select appropriate waypoint switching method; PERPENDICULAR, ARRVL ALM CRCL (default setting), or MANUAL.
6. Press the ENTER soft key.
7. Press the [MENU] key to close the menu.

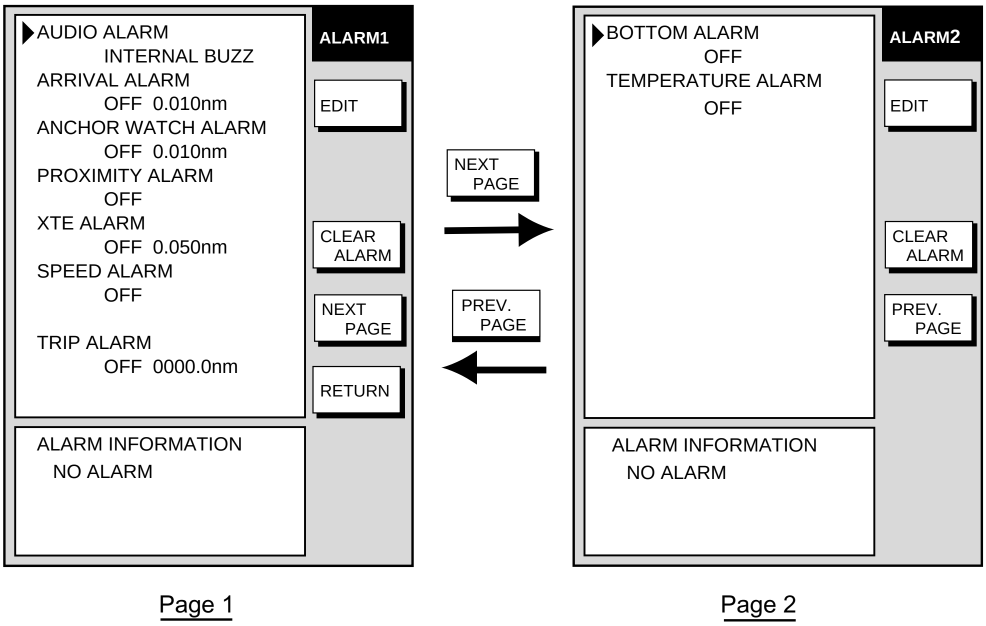
3.10.5 Cancelling route navigation

1. Press the [MENU] key to open the menu.
2. Press the WAYPOINTS/ROUTES soft key.
3. Press the LOG soft key.
4. Press the STOP soft key.
5. Push the [ENTER] knob.
6. Press the RELEASE soft key.
7. Push the [ENTER] knob.

3.11 Alarms

The plotter section has eight conditions which generate both audio and visual alarms: arrival alarm, anchor watch alarm, XTE (Cross Track Error) alarm, proximity alarm, speed alarm, trip alarm, water temperature alarm and bottom alarm. (The bottom and water temperature alarms, which require depth and water temperature data, may also be set on the sounder alarm menu. For these alarms see Chapter 4.)

You may set up the plotter alarms on the ALARM menu, which may be displayed by pressing the [ALARM] key.

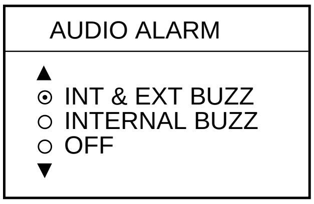


Plotter alarm menu

3.11.1 Audio alarm on/off

Audio and visual alarms are released whenever an alarm setting is violated. You can enable or disable the audio alarm as follows:

1. Press the [ALARM] key to show the alarm menu.
2. Use the trackball to select AUDIO ALARM.
3. Press the EDIT soft key to show the audio alarm window.

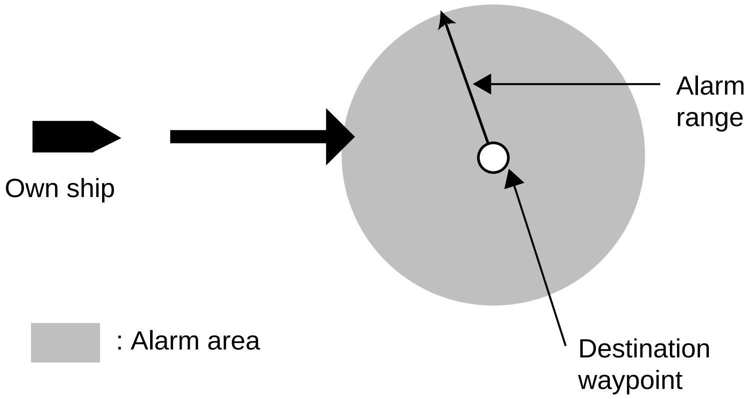


Audio alarm window

4. Use the trackball to select INT & EXT BUZZ (Internal + External alarm), INTERNAL BUZZ (Internal alarm) or OFF. This turns on or off the audio alarm globally for all alarms, including radar.
5. Press the ENTER soft key.
6. Press the [ALARM] key to finish.

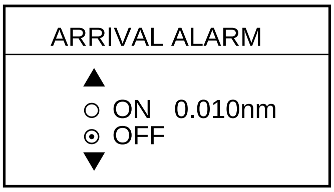
3.11.2 Arrival alarm

The arrival alarm informs you that your boat is approaching a destination waypoint. The area that defines an arrival zone is that of a circle which you approach from the outside of the circle. The alarm will be released if your boat enters the circle. When the arrival alarm is active a dashed circle marks the arrival alarm area. Note that the arrival alarm and anchor watch alarm can be turned on together.



How the arrival alarm works

1. Press the [ALARM] key to open the alarm menu.
2. Use the trackball to select ARRIVAL ALARM.
3. Press the EDIT soft key to show the arrival alarm window.

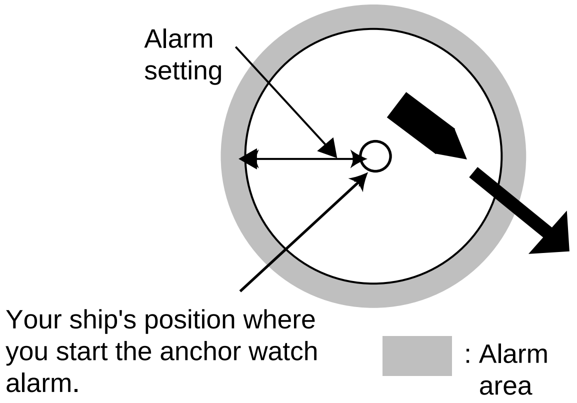


Arrival alarm window

4. Use the trackball to select ON or OFF as appropriate
5. For ON, use the trackball and the [ENTER] knob to enter alarm setting: Operate the trackball to select digit; rotate the [ENTER] knob to set value. The available arrival alarm setting is 0.001 to 9.999 miles.
6. Press the ENTER soft key or push the [ENTER] knob to register setting.
7. Press the [ALARM] key to finish.

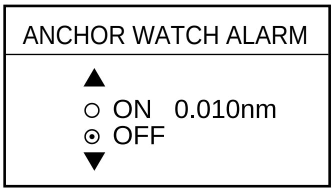
3.11.3 Anchor watch alarm

The anchor watch alarm informs you that your boat is moving when it should be at rest. When the anchor watch is active, a dashed circle with an “X” at its center marks the anchor watch area.



How the anchor watch alarm works

1. Press the [ALARM] key to open the alarm menu.
2. Use the trackball to select ANCHOR WATCH ALARM.
3. Press the EDIT soft key to open the anchor alarm window.



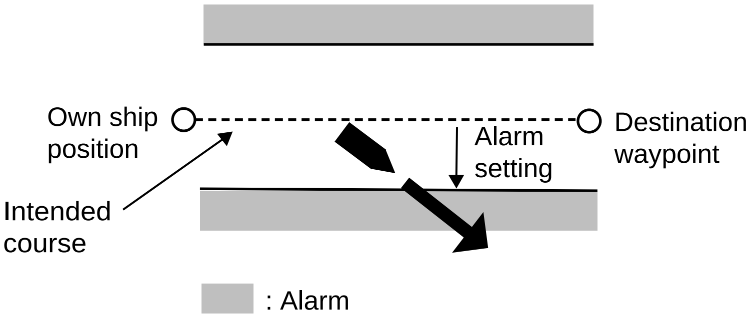
Anchor watch alarm window

4. Use the trackball to select ON or OFF as appropriate.
5. For ON, use the trackball and the [ENTER] knob to enter alarm setting: Operate the trackball to select digit; rotate the [ENTER] knob to set value. The available anchor watch setting is 0.001 to 9.999 miles.
6. Press the ENTER soft key or push the [ENTER] knob to register setting.
7. Press the [ALARM] key to finish.

Note: If the arrival alarm range is changed, turn off the anchor watch alarm and then turn it on again to give priority to the anchor watch alarm.

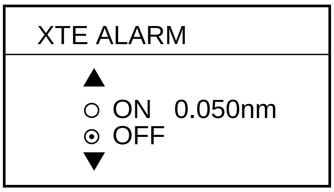
3.11.4 XTE (Cross-Track Error) alarm

The XTE alarm warns you when your boat is off its intended course. When the XTE alarm is active two dashed lines mark the XTE alarm area.



How the XTE alarm works

1. Press the [ALARM] key to open the alarm menu.
2. Use the trackball to select XTE ALARM.
3. Press the EDIT soft key to open the XTE alarm window.



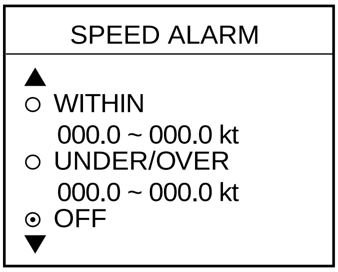
XTE alarm window

4. Select ON or OFF as appropriate.
5. For ON, use the trackball and the [ENTER] knob to enter alarm setting: Operate the trackball to select digit; rotate the [ENTER] knob to set value. The available XTE alarm setting is 0.001 to 9.999 miles.
6. Press the ENTER soft key or push the [ENTER] knob to register setting.
7. Press the [ALARM] key to finish.

3.11.5 Speed alarm

The speed alarm warns when your boat's speed is within or under/over the speed range set.

1. Press the [ALARM] key to open the alarm menu.
2. Use the trackball to select SPEED ALARM.
3. Press the EDIT soft key to display the speed alarm window.

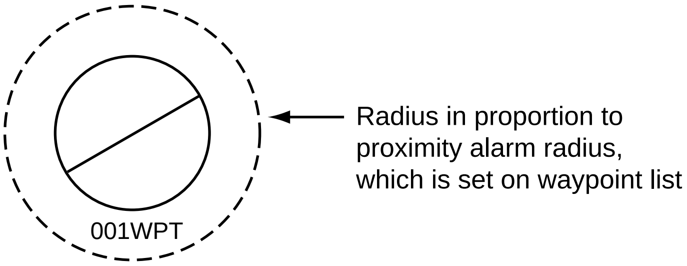


Speed alarm window

4. Use the trackball to select WITHIN, UNDER/OVER, or OFF as appropriate.
5. For WITHIN and UNDER/OVER use the trackball to select digit; rotate the [ENTER] knob to enter value.
6. Press the ENTER soft key or push the [ENTER] knob to register setting.
7. Press the [ALARM] key to finish.

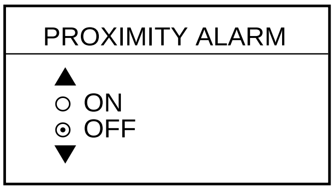
3.11.6 Proximity alarm

The proximity alarm alerts you when own ship nears a waypoint, which is marked with the proximity mark, by the proximity alarm radius set for that waypoint on the waypoint list. When own ship is within a waypoint's proximity alarm radius, the alarm sounds. The proximity mark remains on the screen until the proximity alarm is turned off or the waypoint is erased.



Proximity mark

1. Press the [ALARM] key to open the alarm menu.
2. Use the trackball to select PROXIMITY ALARM.
3. Press the EDIT soft key to show the proximity alarm window.



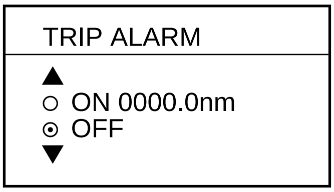
Proximity alarm window

4. Use the trackball to select ON or OFF as appropriate, then press the ENTER soft key.
5. Press the [ALARM] key to finish.

3.11.7 Trip alarm

The trip alarm informs you when you have traveled a certain distance.

1. Press the [ALARM] key to open the alarm menu.
2. Use the trackball to select TRIP ALARM.
3. Press the EDIT soft key to show the trip alarm window.



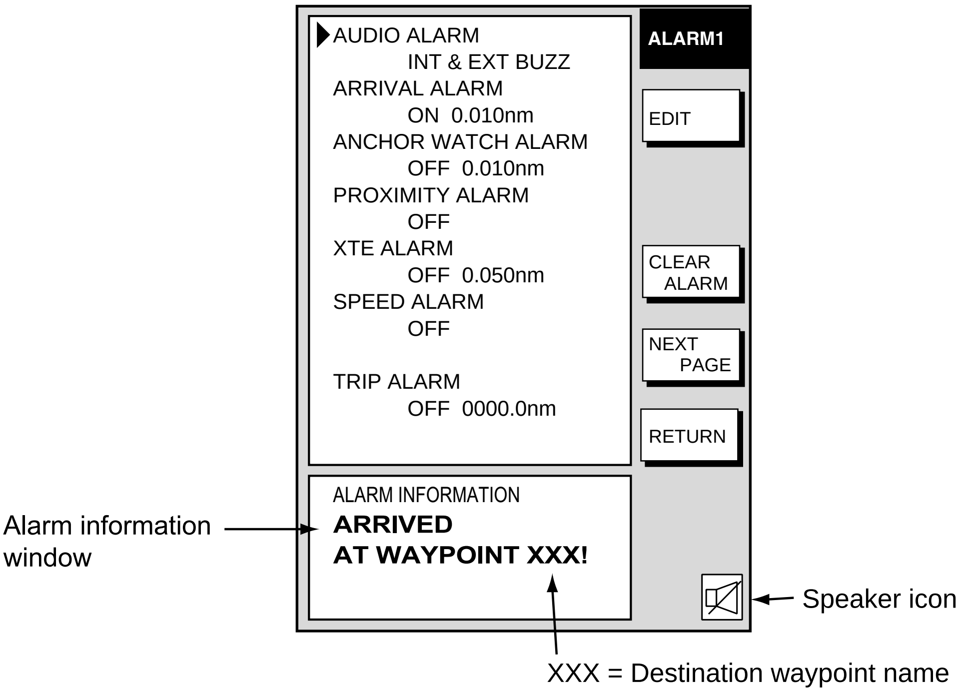
Trip alarm window

4. Select ON or OFF as appropriate.
5. For ON, use the trackball and the [ENTER] knob to enter alarm setting: Operate the trackball to select digit; rotate the [ENTER] knob to set value.
6. Press the ENTER soft key or push the [ENTER] knob to register setting.
7. Press the [ALARM] key to finish.

3.11.8 Alarm information

When an alarm setting has been violated, the buzzer sounds and the speaker icon appears. Press the [CLEAR] key to silence the alarm. You can see which alarm has been violated on the ALARM menu. In the example below the arrival alarm has been violated.

1. Press the [ALARM] key. The name of the offending alarm appears in the alarm information window.



Plotter alarm menu, page 1

2. Press the CLEAR ALARM soft key to acknowledge the alarm (and silence the buzzer if it was not already done with the [CLEAR] key). The speaker icon remains on the screen until the reason for the alarm is eliminated or the alarm is disabled. If more than one alarm has been violated, the message CONTINUE appears at the bottom of the alarm information window. In this case, press the NEXT INFO soft key to see which other alarms have been violated.
3. Press the [ALARM] key to close the alarm menu.

Alarm messages

The table below shows the plotter alarm messages and their meanings.

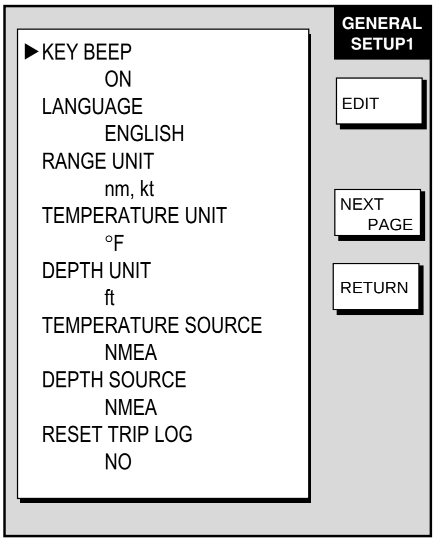
Plotter alarm messages and their meanings

Message	Meaning
ARRIVED AT XXX WAYPOINT! (XXX = waypoint name)	Arrival alarm violated.
ENTERED INTO AVOIDANCE AREA!	Proximity alarm violated.
EXCEEDED ANCHOR WATCH LIMIT!	Anchor watch alarm violated.
EXCEEDED XTE LIMIT!	XTE alarm violated.
SPEED ALARM!	Speed alarm violated.
TEMPERATURE ALARM!	Water temperature alarm violated.
TRIP ALARM! MILEAGE EXCEEDED	Trip alarm violated.

3.12 Resetting Trip Distance

Trip distance is shown on the navigation data display. You can reset the trip distance to zero as follows:

1. Press the [MENU] key.
2. Press the SYSTEM CONFIGURATION and GENERAL SETUP soft keys in that order to show the GENERAL SETUP menu.



General setup menu, page 1

3. Use the trackball to select RESET TRIP LOG, then press the EDIT soft key.
4. Use the trackball to select YES, then press the ENTER soft key.
5. Press the [MENU] key to close the menu.

4. VIDEO SOUNDER OPERATION

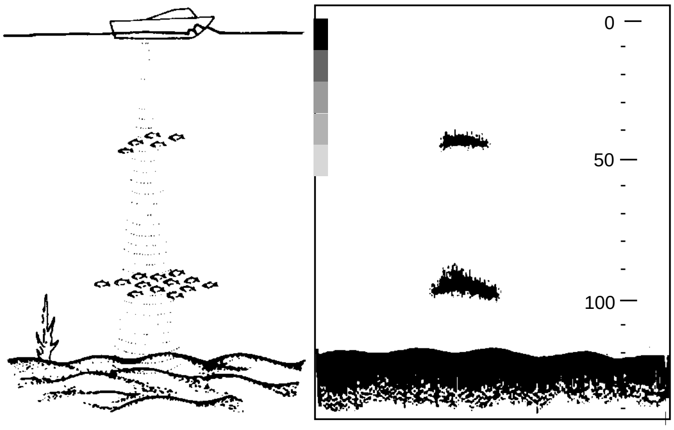
With connection of the optional Network Sounder ETR-6/10N you can show video sounder images on the display.

4.1 Principle of Operation

The video sounder determines the distance between its transducer and underwater objects such as fish, lake bottom or seabed and displays the results on screen. It does this by utilizing the fact that an ultrasonic wave transmitted through water travels at a nearly constant speed of 4800 feet (1500 meters) per second. When a sound wave strikes an underwater object such as fish or sea bottom, part of the sound wave is reflected back toward the source (transducer). Thus by calculating the time difference between the transmission of a sound wave and the reception of the reflected sound wave, the depth to the object can be determined.

The entire process begins in the network sounder. Transmitter power is sent to the transducer as a short pulse of electrical energy. The electrical signal produced by the transmitter is converted into an ultrasonic signal by the transducer and transmitted into the water. Any returning signals from intervening objects (such as a fish school) are received by the transducer and converted into an electrical signal. The signals are then amplified in the amplifier section, and finally, displayed on screen.

The picture displayed is made up of a series of vertical scan lines, one for each transmission. Each line represents a snapshot of what has occurred beneath the boat. A series of snapshots are accumulated side by side across the screen, and the resulting contours of the bottom and fish between the bottom and surface are displayed.



Underwater conditions and video sounder display

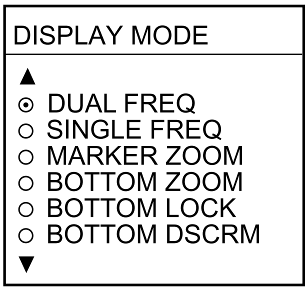
4.2 Sounder Displays

4.2.1 Selecting a sounder display

There are seven display modes from which to choose: dual frequency, single frequency, marker zoom, bottom zoom, bottom lock, bottom discrimination, and A-scope.

To select a display;

1. Press the [DISP] key and select a sounder display.
2. If not displayed, press the [HIDE/SHOW] key to show the sounder soft keys.
3. Press the DISPLY MODE soft key to show the display mode window.



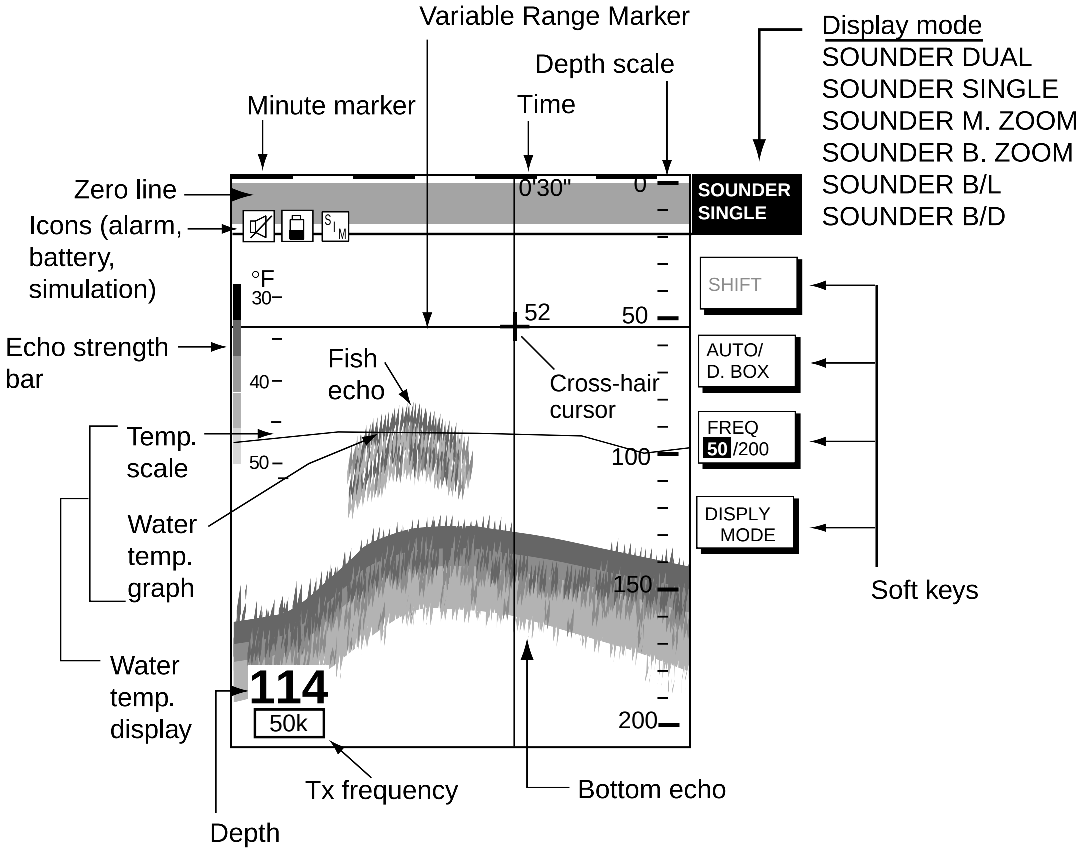
Display mode window

4. Use the trackball or [ENTER] knob to select a display.
5. Press the RETURN soft key to close the window.

Note: On menus which show the RETURN soft key you may press it or the ENTER knob to register setting and close the window.

4.2.2 Description of sounder displays

Single-frequency display



Indications on the single frequency display

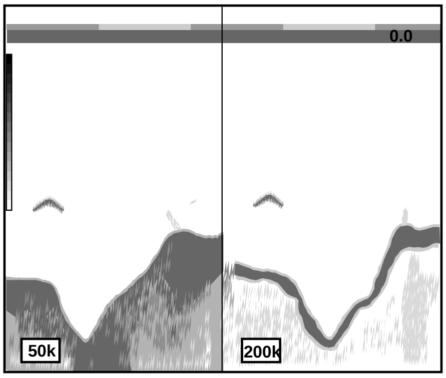
Note: The water temperature display requires an appropriate water temperature sensor. It can be turned on or off with TEMPERATURE GRAPH on the SOUNDER menu.

Selecting transmission frequency

The single frequency display shows either the 50 kHz picture or 200 kHz picture. To select transmission frequency, press the FREQ 50/200 soft key. “50” or “200” is highlighted on its key label with each press of the key.

Dual-frequency display

The dual-frequency display provides both 50 kHz and 200 Hz pictures. This display is useful for comparing the same picture with two different sounding frequencies.



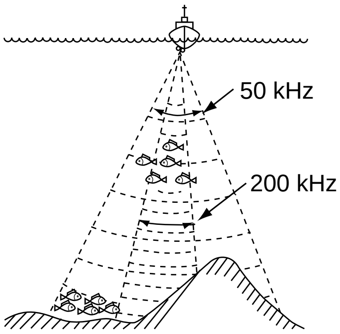
Dual-frequency display

50 kHz picture

The sounder uses ultrasonic pulses to detect bottom conditions. The lower the frequency of the pulse, the wider the detection area. Therefore, the 50 kHz frequency is useful for general detection and judging bottom condition.

200 kHz picture

The higher the frequency of the ultrasonic pulse the better the resolution. Therefore, the 200 kHz frequency is ideal for detailed observation of fish school.

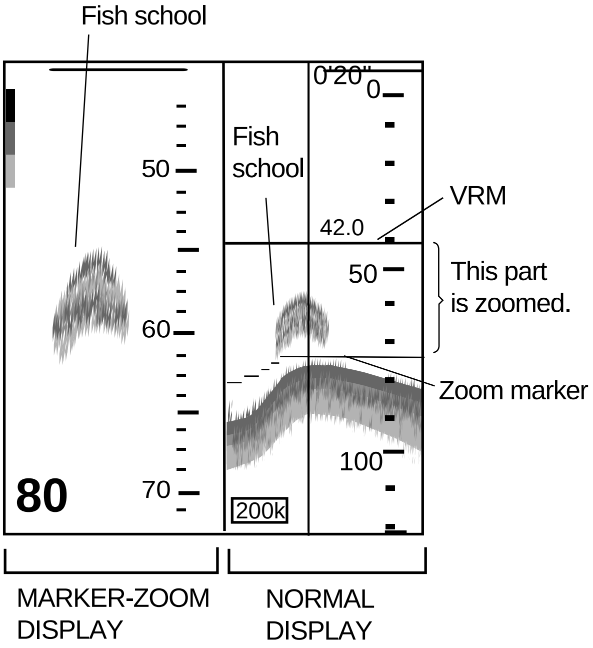


Sounding area and transmission frequency

Marker-zoom display

The marker-zoom display expands a selected area of the normal sounder picture to full vertical size of the screen on the left-half window. You may specify the portion to expand by operating the VRM (Variable Range Marker), which you can shift with the [ENTER] knob. The area between the VRM and zoom marker is expanded. The length of the segment is equal to one division of the depth scale.

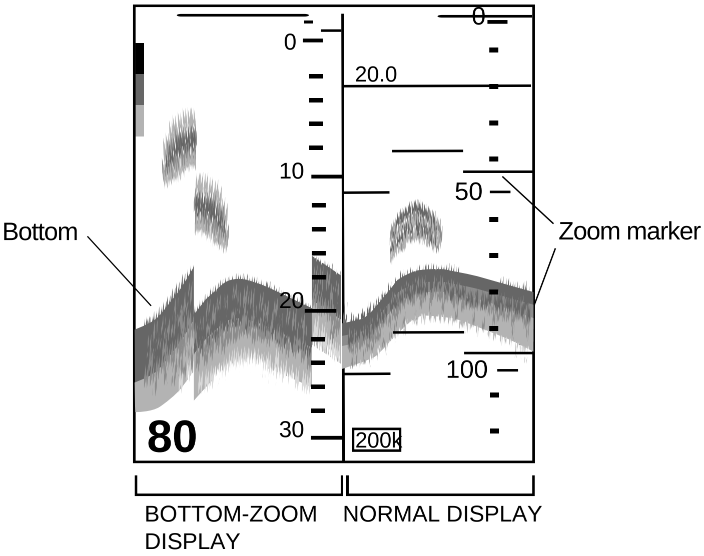
Note: The VRM is set independently from other displays in case of multiple displays.



Marker-zoom display plus normal sounder display

Bottom-zoom display

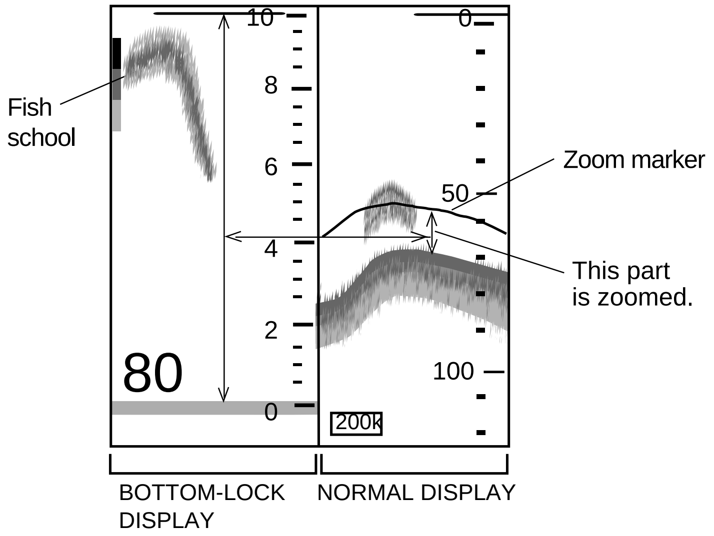
The bottom-zoom display expands bottom and bottom fish echoes by the zoom range selected on the SOUNDER RANGE SETUP menu (see paragraph 5.9.3), and is useful for determining bottom hardness. A bottom displayed with a short echo tail usually means it is a soft, sandy bottom. A long echo tail means a hard bottom.



Bottom-zoom display plus normal sounder display

Bottom-lock display

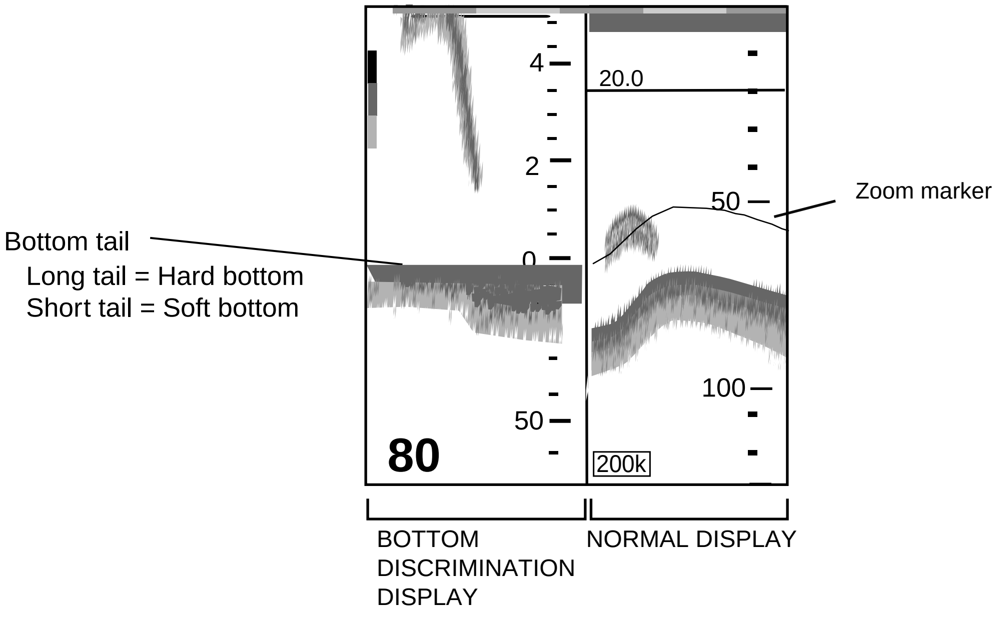
The bottom-lock display provides a compressed normal picture on the right half of the screen and a 10 or 20 feet (3 or 6 meter) wide layer in contact with the bottom is expanded onto the left half of the screen. This mode is useful for discriminating bottom fish from the bottom echo. You may select the bottom lock range from the SOUNDER RANGE SETUP menu. For details, see paragraph 5.9.3.



Bottom-lock display plus normal sounder display

Bottom discrimination display

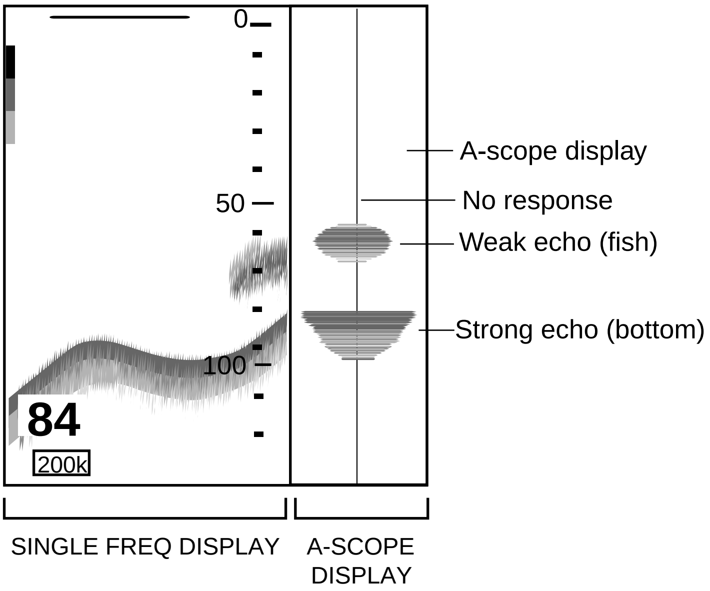
The bottom discrimination mode displays the bottom echo to help you determine bottom hardness. A bottom displayed with a short echo tail usually means it is a soft, sandy bottom. A long echo tail means a hard bottom.



Bottom discrimination display

A-scope display (display only)

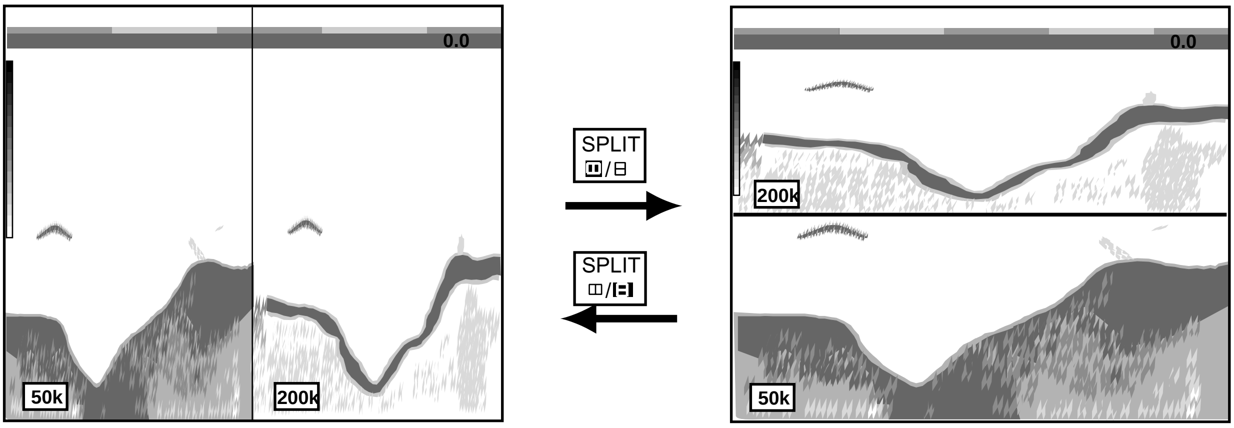
The A-scope display, available in all modes, shows echoes at each transmission with amplitudes and tone proportional to their intensities, on the right 1/10 of the screen. It is useful for estimating fish species and bottom composition. To turn on the A-scope display, press the DISPLAY MODE soft key, select display mode desired, then press the A-SCPE soft key to show "ON" on its label. For modes other than SINGLE FREQ the screen must be split horizontally to show the A-scope display.



A-scope display

4.2.3 Selecting screen split method in combination displays

On combination sounder displays you can split the screen vertically or horizontally, using the SPLIT soft key as below.



How to use the SPLIT soft key (example: dual frequency display)

4.3 Automatic Sounder Operation

Automatic sounder operation is useful when you are preoccupied with other tasks and do not have the time to adjust the display.

4.3.1 How the automatic sounder works

The automatic sounder function automatically selects the proper gain, range scale and clutter suppression level according to the depth. It works as follows:

- The range changes automatically to locate the bottom on the lower half of the screen. The range jumps to one step shallower range when the bottom echoes reach a half way point of the full scale from the top and to one step deeper range when they come to the lower edge of the scale.
- The gain is automatically adjusted to display the bottom echo in the darkest tone.
- Clutter, which suppresses low level noise, is automatically adjusted.

4.3.2 Types of automatic sounder modes

Two types of automatic sounder modes are available: CRUISING and FISHING. CRUISING is for tracking the bottom, and FISHING is for searching fish schools. CRUISING uses a higher clutter rejection setting than FISHING therefore it is not recommended for fish detection - weak fish echoes may be erased by the clutter suppression circuit.

4.3.3 How to enable automatic sounder operation

1. If not displayed, press the [HIDE/SHOW] key to show the sounder soft keys.
2. Press the AUTO/D. BOX soft key.

```
AUTO MODE
▲
⊙ CRUISING
○ FISHING
○ OFF (MANUAL)
▼
```

Mode/frequency window

3. Use the trackball or the [ENTER] knob to select CRUISING or FISHING as appropriate.
4. Press the RETURN soft key to close the window.

4.4 Manual Sounder Operation

Manual operation is useful for observing fish schools and bottom using a fixed gain setting.

The gain, range and range shift functions used together give you the means to select the depth you can see on the screen. The basic range can be thought of as providing a “window” into the water column and range shifting as moving the “window” to the desired depth.

4.4.1 Selecting the manual mode

1. If not displayed, press the [HIDE/SHOW] key to show the sounder soft keys.
2. Press the AUTO/D. BOX soft key to show the mode/frequency window.
3. Select OFF (MANUAL).
4. Press the RETURN soft key.

4.4.2 Selecting display range

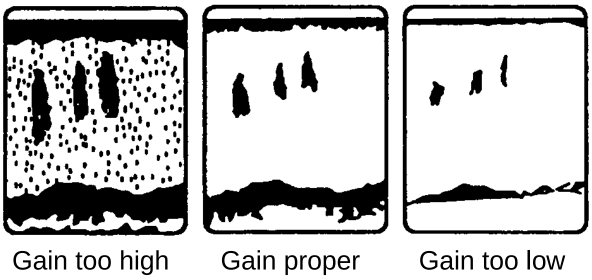
Press the [RANGE +] or [RANGE -] key to select a range. The default ranges in feet, meters, fathoms and passi/braza are as below. Note that the range cannot be changed in the automatic sounder mode.

Default sounder ranges

Range 1	Range 2	Range 3	Range 4	Range 5	Range 6	Range 7	Range 8
15 ft	30 ft	60 ft	120 ft	200 ft	400 ft	1000 ft	4000 ft
5 m	10 m	20 m	40 m	80 m	150 m	300 m	1200 m
3 fa	5 fa	10 fa	20 fa	40 fa	80 fa	150 fa	650 fa
3 P/B	5 P/B	10 P/B	30 P/B	50 P/B	100 P/B	200 P/B	700 P/B

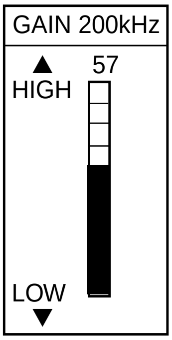
4.4.3 Adjusting the gain

Normally, set the gain to the point where excessive noise does not appear on the screen. Use a higher gain setting for greater depths and a lower setting for shallow waters.



Examples of proper and improper gain

Press the [GAIN] key to show the gain window, and adjust the [ENTER] knob or trackball. Current level is shown on the bar. Press the RETURN key to finish. The setting range is 0-100(%).



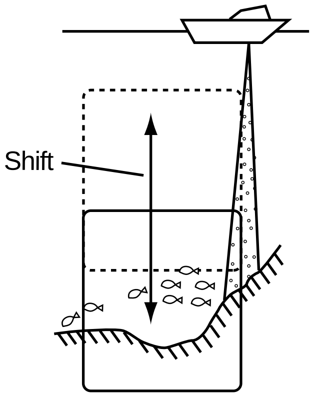
Gain window

Note 1: On the dual-frequency display, the gain can be independently set for 50 kHz and 200 kHz. Use the FREQ 50/200 soft key to select the frequency for which to adjust gain.

Note 2: Gain cannot be adjusted in the automatic sounder mode. The message “SOUNDER GAIN CANNOT BE CHANGED IN AUTO MODE” is displayed when you attempt to do so.

4.4.4 Shifting the range

The basic range may be shifted up or down as desired by pressing the SHIFT soft key followed by adjusting the [ENTER] knob or the trackball. Press the RETURN soft key to finish.

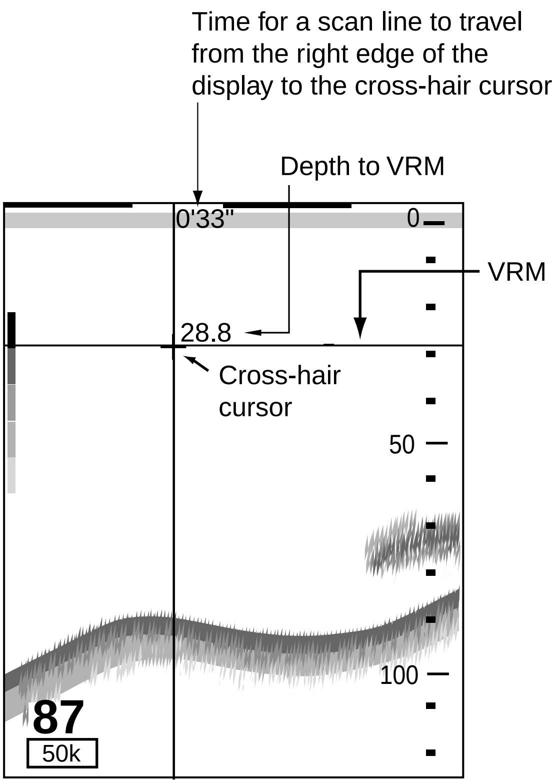


Shift concept

4.5 Measuring Depth, Time

The VRM measures the depth and the cross-hair cursor, time..

1. Rotate the [ENTER] knob to shift the VRM; counterclockwise to shift it downward, clockwise to shift it upward. You may also use the trackball to shift the VRM.
2. Roll the trackball horizontally to adjust the time cursor to measure time.

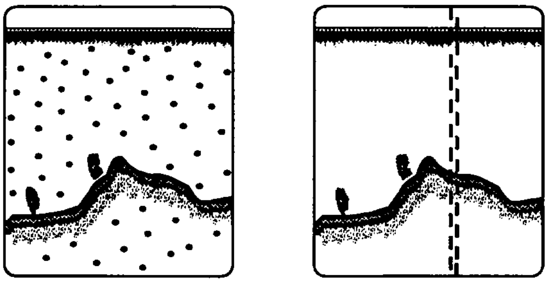


How to measure depth and time

Note: If, when the range setting is over 1000 ft (m, fa, p/b), the VRM indication and depth scale may overlap one another, shift the cross-hair cursor slightly to show them completely. Further, when the display is shifted, the depth scale may obscure the time indication.

4.6 Reducing Interference

Interference from other acoustic equipment operating nearby or other electronic equipment on your boat may show itself on the display as shown below.



Interference from other sounder

Electrical inteference

Types of interference

To reduce interference, do the following:

1. Press the [MENU] key.
2. Press the SOUNDER MENU soft key.
3. Select NOISE LIMITER, then press the EDIT soft key to show the noise limiter window.

NOISE LIMITER
▲
⊙ OFF
○ LOW
○ MEDIUM
○ HIGH
▼

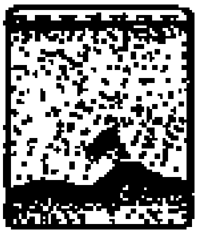
Noise limiter window

4. Use the trackball to select the degree of suppression desired (LOW, MEDIUM, HIGH), or turn the noise limiter off.
5. Press the RETURN soft key followed by the [MENU] key to close the menu.

Turn the noise limiter circuit off when no interference exists, otherwise weak echoes may be missed.

4.7 Reducing Low Level Noise

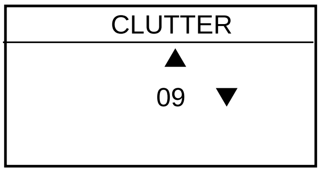
Dots may appear over most of the screen. This is mainly due to sediment in the water, or noise. This noise can be suppressed by adjusting CLUTTER on the SOUNDER menu.



Appearance of clutter

When the automatic sounder mode is used, clutter is automatically adjusted. To reduce low level noise in manual sounder operation do the following:

1. Press the [MENU] key.
2. Press the SOUNDER MENU soft key.
3. Select CLUTTER and press the EDIT soft key to show the clutter window.



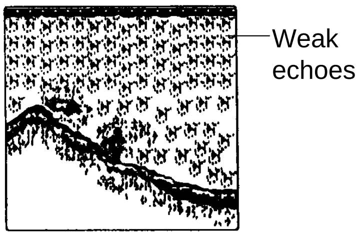
Clutter window

4. Use the trackball to select clutter rejection level desired; 0 (OFF) through 16, default setting, 9. The higher the number the higher the degree of suppression. Note that the clutter suppressor may erase weak echoes. Therefore, turn off the clutter when its use is not required.
5. Press the RETURN soft key followed by the [MENU] key to close the menu.

Note: Unlike the signal level feature, clutter does not erase echoes. However, if you do not wish to change the relation between weak and strong echoes, use signal level instead.

4.8 Erasing Weak Echoes

Sediments in the water or reflections from plankton may be painted on the display as “spots” on the background. These weak echoes may be erased as below.



Appearance of weak echoes

1. Press the [MENU] key.
2. Press the SOUNDER MENU soft key.
3. Select SIGNAL LEVEL, and press the EDIT soft key to show the signal level window.

SIGNAL LEVEL
▲
⊙ OFF
○ SL1
○ SL2
▼

Signal level window

4. Use the trackball to select level of erasure or OFF as appropriate. The higher the number the stronger the echo that will be erased.
5. Press the RETURN soft key followed by the [MENU] key to close the menu.

Note: Unlike “clutter,” signal level erases echoes. Therefore, if you do not wish to erase echoes, use clutter instead.

4.9 Picture Advance Speed

The picture advance speed determines how quickly the vertical scan lines run across the screen. When selecting a picture advance speed, keep in mind that a fast advance speed will expand the size of the fish school horizontally on the screen and a slow advance speed will contract it.

The advancement speed may be set independent of or synchronized with ship's speed.

4.9.1 Advancement independent of ship's speed

1. Press the [MENU] key.
2. Press the SOUNDER MENU soft key.
3. Select PICTURE ADVANCE, and press the EDIT soft key to open the picture advance window.

PICTURE ADVANCE
▲
⊙ 2/1
○ 1/1
○ 1/2
○ 1/4
○ 1/8
○ 1/16
○ STOP
▼

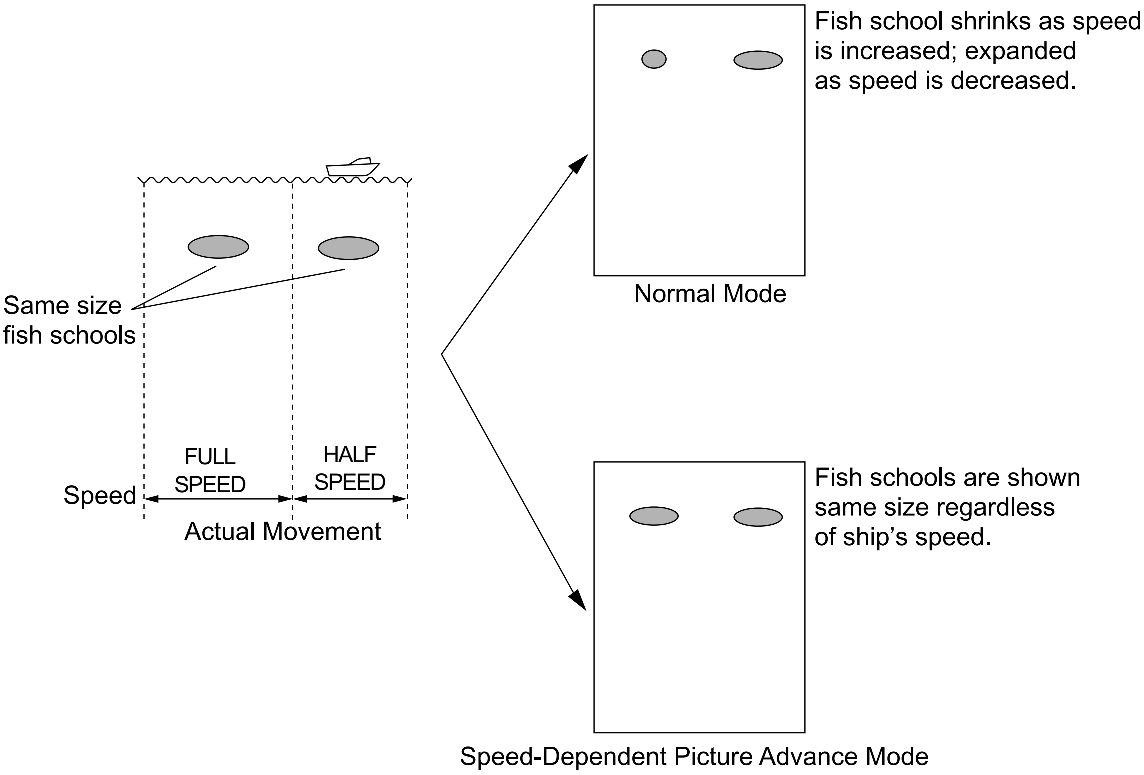
Picture advance window

4. Use the trackball to select speed desired. The fractions in the window denote the number of scan lines produced per transmission. For example, 1/8 means one scan line is produced every eight transmissions. STOP freezes the display and it is convenient for observing an echo.
5. Press the RETURN soft key followed by the [MENU] key to close the menu.

Note: When using the plotter/sounder combination display, advancement of the sounder picture may be temporarily interrupted while the plotter display is being shifted or its display range is being changed.

4.9.2 Advancement synchronized with ship's speed

With speed data provided by a speed-measuring device, picture advance speed may be automatically synchronized with ship's speed. As shown in the figure below the horizontal scale of the display is not influenced with the speed-dependent picture advance mode active, thus it permits judgment of fish school size and abundance at any speed. With the advancement synchronized with ship's speed the picture advance speed setting (on the previous page) is ignored.



How the speed-dependent picture advance mode works

<u>Activating/deactivating the speed-dependent picture advance mode</u>

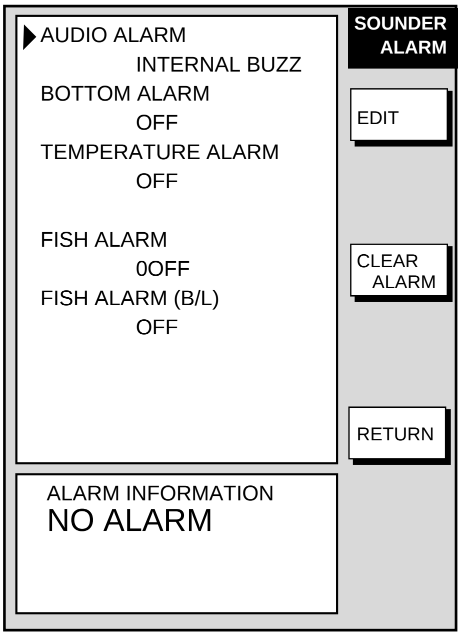
1. Press the [MENU] key followed by the SOUNDER MENU soft key.
2. Select SPD SENSING PIC ADV.
3. Press the EDIT soft key to open the setting window.
4. Use the trackball to select ON or OFF (default setting) as appropriate.
5. Press the ENTER soft key followed by the [MENU] key to close the menu.

Note: Use the same speed data sentence (STG or STW) throughout the network for smooth advancement of the sounder picture. See the paragraph 6.5 for how to output data through the network.

4.10 Alarms

The sounder section has five conditions which generate audio and visual alarms: bottom alarm, fish alarm (bottom lock), fish alarm (normal), water temperature alarm (temperature sensor required), and speed alarm.

You may set up the sounder alarms on the ALARM menu, which may be displayed by pressing the [ALARM] key.

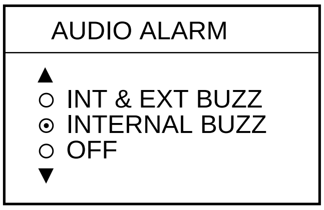


Sounder alarm menu

4.10.1 Audio alarm on/off

The audio alarm sounds whenever an alarm setting is violated. You can enable or disable the audio alarm as follows:

1. Press the [ALARM] key to show the ALARM menu.
2. Use the trackball to select AUDIO ALARM.
3. Press the EDIT soft key to show the audio alarm window.



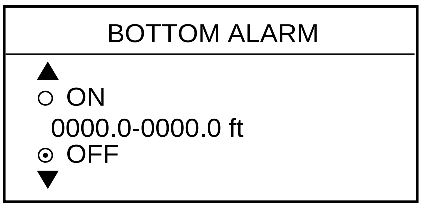
Audio alarm window

4. Use the trackball to select INT & EXT BUZZ (Internal + External alarm), INTERNAL BUZZ (Internal alarm) or OFF. External buzzer required to select “INT+EXT BUZZ.” OFF globally turns the audio alarm on or off for all modes, including radar.
5. Press the ENTER soft key, then press the [ALARM] key to close the menu.

4.10.2 Bottom alarm

The bottom alarm sounds when the bottom echo is within the alarm range set. To activate the bottom alarm, the depth must be displayed. Note that the bottom alarm is turned on or off reciprocally with the bottom alarm on the plotter alarm menu.

1. Press the [ALARM] key to show the ALARM menu.
2. Use the trackball to select BOTTOM ALARM.
3. Press the EDIT soft key to show the bottom alarm window.



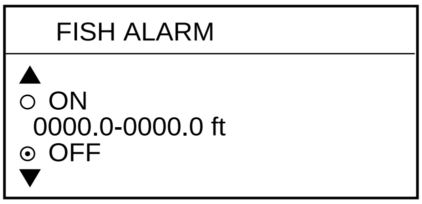
Bottom alarm window

4. Use the trackball to select ON or OFF as appropriate. For ON, enter alarm range with the trackball and [ENTER] knob: Rotate the trackball horizontally to select digit; rotate the [ENTER] knob to set value.
5. Press the ENTER soft key or push the [ENTER] knob to register setting.
6. Press the [ALARM] key to close the menu.

4.10.3 Fish alarm

The fish alarm sounds when a fish echo is within the preset alarm range. Note that the sensitivity of the fish alarm can be set on the SOUNDER SYSTEM SETUP menu.

1. Press the [ALARM] key to show the ALARM menu.
2. Use the trackball to select FISH ALARM.
3. Press the EDIT soft key to show the fish alarm window.



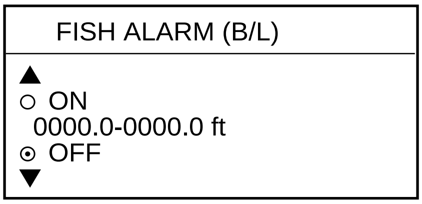
Fish alarm window

4. Use the trackball to select ON or OFF as appropriate. For ON, use the trackball and [ENTER] knob to enter alarm range: Use rotate the trackball horizontally to select digit; rotate the [ENTER] knob to set value.
5. Press the ENTER soft key or push the [ENTER] knob to register setting.
6. Press the [ALARM] key to close the menu.

4.10.4 Fish alarm (B/L)

The bottom-lock fish alarm sounds when a fish echo is within a predetermined distance from the bottom. Note that the sensitivity of the fish alarm can be set on the SOUNDER SYSTEM SETUP menu.

1. Press the [ALARM] key to show the ALARM menu.
2. Use the trackball to select FISH ALARM (B/L).
3. Press the EDIT soft key to show the fish alarm (B/L) window.



Fish alarm (B/L) window

4. Use the trackball to select ON or OFF as appropriate. For ON, use the trackball and [ENTER] knob to enter alarm range: Operate the trackball to select digit; rotate the [ENTER] knob to set value.
5. Press the ENTER soft key or push the [ENTER] knob to register setting.
6. Press the [ALARM] key to close the menu.

4.10.5 Water temperature alarm

There are two types of water temperature alarms: WITHIN RANGE and OUT OF RANGE. The WITHIN RANGE alarm sounds when the water temperature is within the range set, and the OUT OF RANGE alarm sounds when the water temperature is higher or lower than the range set. Note that the water temperature alarm is turned on or off reciprocally with the water temperature alarm on the plotter menu.

1. Press the [ALARM] key to show the ALARM menu.
2. Use the trackball to select TEMPERATURE ALARM.
3. Press the EDIT soft key to show the temperature alarm window.

TEMPERATURE ALARM

▲
○ WITHIN RANGE
+000.0 - +000.0°F
○ OUT OF RANGE
+000.0 - +000.0°F
⊙ OFF
▼

Water temperature alarm window

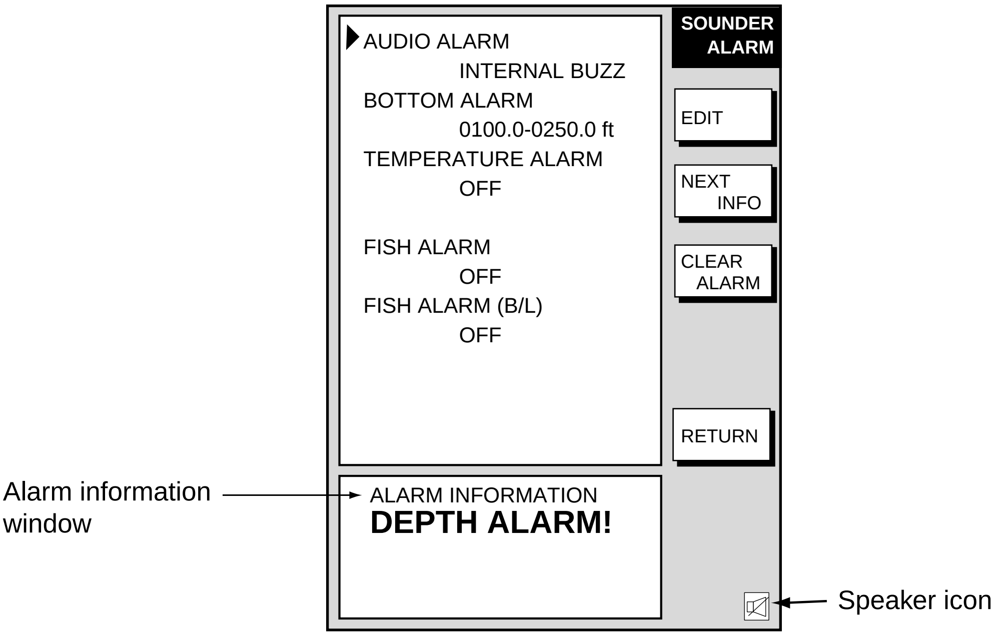
4. Use the trackball to select WITHIN RANGE, OUT OF RANGE or OFF as appropriate. For WITHIN, use the trackball and [ENTER] knob to enter alarm range: Operate the trackball to select digit; rotate the [ENTER] knob to set value.
5. Press the ENTER soft key or push the [ENTER] knob to register setting.
6. Press the [ALARM] key to close the menu.

4.10.6 When an alarm setting is violated...

When an alarm setting has been violated the buzzer sounds and the speaker icon appears. Press the [CLEAR] key to silence the alarm. You can see which alarm has been violated on the alarm menu display. In the example below the bottom alarm has been violated.

To see which alarm(s) has been violated:

1. Press the [ALARM] key. The name of the offending alarm is shown in the alarm information window.



Sounder alarm menu

2. Press the CLEAR ALARM soft key to acknowledge the alarm (and silence the buzzer if it has not already been done with the [CLEAR] key). The speaker icon remains on the screen until the reason for the alarm is eliminated or the alarm is disabled. If more than one alarm has been violated, the message CONTINUE appears at the bottom of the alarm information window. In this case, press the NEXT INFO soft key to see which other alarms have been violated.
3. Press the [ALARM] key to close the menu.

Alarm messages

The table below shows the sounder alarm messages and their meanings.

Sounder alarm messages and their meanings

Message	Meaning
DEPTH ALARM!	Bottom alarm violated.
FISH ALARM!	Fish alarm violated.
TEMPERATURE ALARM!	Water temperature alarm violated.

4.11 Water Temperature Graph

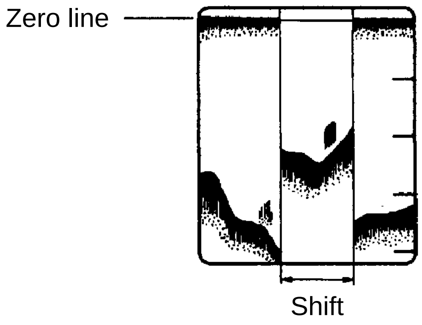
The water temperature graph (appropriate sensor required) plots water temperature on the sounder display. (See the figure on page 4-3.) It can be turned on or off as below.

1. Press the [MENU] key to open the menu.
2. Press the SOIUNDER MENU soft key.
3. Select TEMPERATURE GRAPH and press the EDIT soft key.
4. Select OFF (default setting) or ON as appropriate.
5. Press the ENTER soft key.
6. Press the key to close the menu.

4.12 Interpreting the Sounder Display

4.12.1 Zero line

The zero line (sometimes referred to as the transmission line) represents the transducer's position, and moves off the screen when a deep phased range is used.



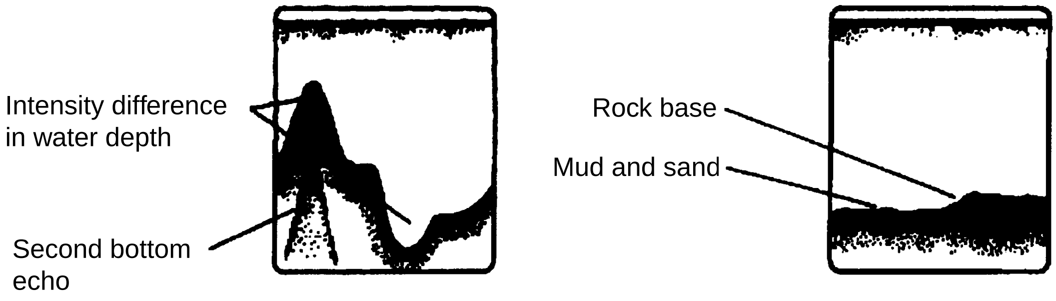
Zero line

4.12.2 Bottom echo

Echoes from the bottom are normally the strongest and are displayed in the darkest tone, but the tone and width will vary with bottom composition, water depth, frequency, sensitivity, etc.

In a comparatively shallow depth, a high gain setting will cause a second or sometimes a third or a fourth echo to be displayed at the same interval between them below the first echo trace. This is because the echo travels between the bottom and the surface twice or more in shallow depths.

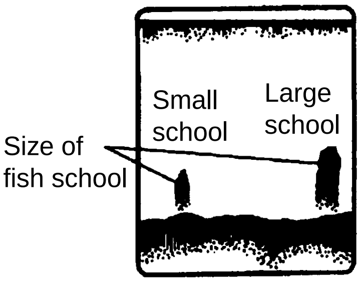
The tone of the bottom echo can be used to help determine the density of the bottom materials (soft or hard). The harder the bottom, the wider the trace. If the gain is set to show only a single bottom echo on mud, a rocky bottom will show a second or third bottom return. The range should be chosen so the first and second bottom echoes are displayed when bottom hardness is being determined.



Bottom echoes

4.12.3 Fish school echoes

Fish school echoes will generally be plotted between the zero line and the bottom. Usually the fish school/fish echo is weaker than the bottom echo because its reflection property is much smaller compared to the bottom. The size of the fish school can be ascertained from the density of the display.

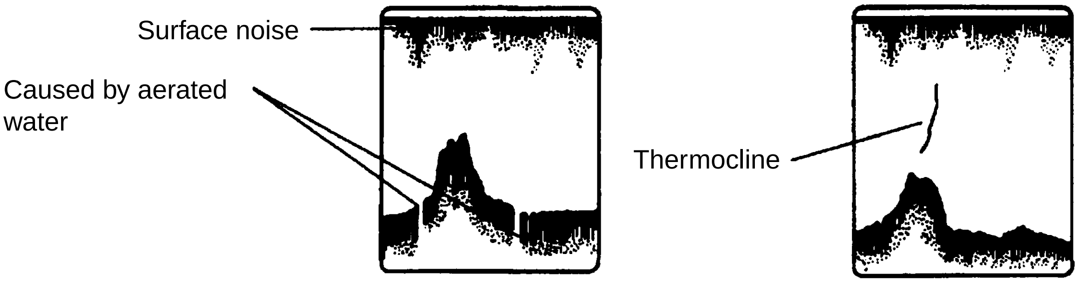


Fish school echoes

4.12.4 Surface noise/Aeration

When the waters are rough or the boat passes over a wake, surface noise may appear near the zero line. As surface turbulence is acoustically equivalent to running into a brick wall, the bottom echo will be displayed intermittently. Similar noise sometimes appears when a water temperature difference (thermocline) exists. Different species of fish tend to prefer different temperature zones, so the thermocline may be useful to help identify target fish. 200 kHz tends to show shallow thermoclines better than 50 kHz.

In rough waters the display is occasionally interrupted due to below-the-ship air bubbles obstructing the sound path. This also occurs when the boat makes a quick turn or reverses movement. Lowering the picture advance speed may reduce the interruption. However, reconsideration of the transducer installation may be necessary if the interruption occurs frequently.



Surface noise/aeration

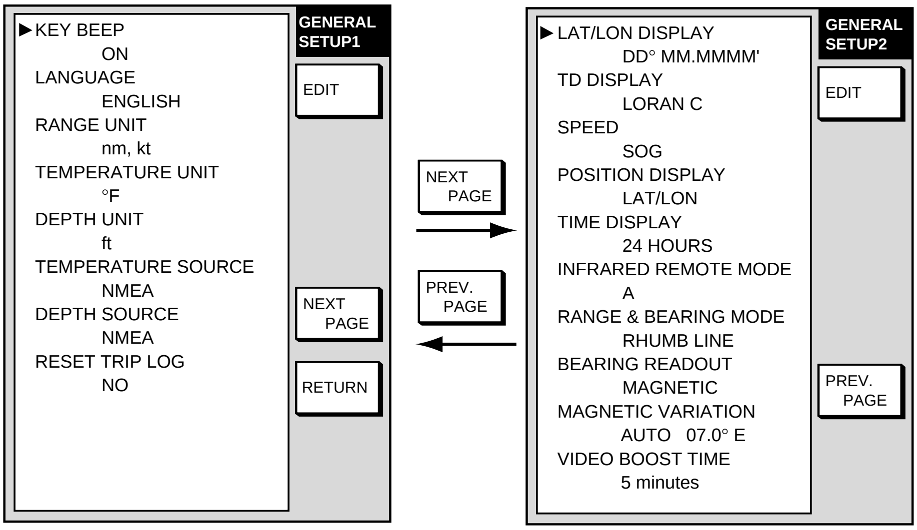
5. CUSTOMIZING YOUR UNIT

This chapter describes the various options which allow you to set up your unit to suit your needs. For mode-specific menus, e.g. radar, plotter and sounder, make sure that you select the appropriate display when making changes or viewing menu options.

5.1 General Setup

This paragraph shows you how to set up functions common to the plotter, radar and sounder displays. This is done on the GENERAL SETUP menu, which you may display from any mode. These items include language, key beep, units of measurement, data sources, etc.

1. Press the [MENU] key to display the main menu.
2. Press the SYSTEM CONFIGURATION soft key.
3. Press the GENERAL SETUP soft key.



General setup menu

4. Press the NEXT PAGE or PREV. PAGE soft key to switch pages if necessary.
5. Use the trackball to select item.
6. Press the EDIT soft key.
7. Use the trackball to select option desired, then press the ENTER soft key.
8. Press the [MENU] key to close the menu.

Contents of general setup menu

Item	Description	Settings	Default Setting
Key Beep	Turns key beep on/off.	On, Off	On
Language	Chooses menu language.	English, French, German, Italian, Portuguese, Spanish	English
Range Unit	Chooses unit of range and speed measurement.	nm, kt; km, km/h; sm, mph; nm & yd, kt; nm & m, kt; km & m, km/h; sm & yd, mph	nm, kt
Temperature Unit	Chooses unit of water temperature measurement.	°C,°F	°F
Depth Unit	Chooses unit of depth measurement.	ft, m, fa, P/B (Passi/Braza)	ft
Temperature Source	Chooses source of water temperature data.	ETR, NMEA. Select ETR to show water temperature data fed from the network sounder.	NMEA
Depth Source	Chooses source of depth data.	ETR, NMEA. Select ETR to show depth data fed from the network sounder.	NMEA
Reset Trip Log	Resets distance run to zero.	Yes, No	No
Lat/Lon Display	Chooses how many digits (or seconds) to display after decimal point in latitude and longitude position.	DD°MM.MM', DD°MM.MMM', DD°MM.MMMM', DD°MM'SS.S"	DD°MM.MMMM'
TD Display	Chooses TD type.	Loran C, Decca	Loran C
Speed	Chooses speed display format.	SOG (Speed over ground), STW (Speed through water)	SOG
Position Display	Chooses position display format.	LAT/LON, TD	LAT/LON
Time Display	Chooses time notation.	12 hours, 24 hours	24 hours
Infrared Remote Mode	A remote controller can be set exclusively for use with a specific display unit, in the case of multiple NavNet display units. For further details see the Installation Manual.	A, B, C, D	A
Range & Bearing Mode	Chooses how to calculate range and bearing.	**Rhumb Line:** Straight line drawn between two points on a nautical chart. **Great Circle:** Shortest course between two points on the surface of the earth.	Rhumb Line

(Con't on next page)

Contents of general setup menu (con't from previous page)

Item	Description	Settings	Default Setting
Bearing Readout	Chooses bearing readout for course, course over ground and cursor bearing.	True, Magnetic	Magnetic
Magnetic Variation	The magnetic variations for all areas of the earth are preprogrammed into this unit. The preprogrammed variation is accurate for most instances, however you may wish to manually enter a variation. For manual input, select Manual, hit the EDIT soft key, enter value, then hit the ENTER soft key to set. "AUTO" requires position data.	Auto, Manual	Auto (07.0°W)
Video Boost Time	Sets the amount of time to use increased brilliance when the BRILL BOOST soft key is operated.	3, 5, 10, 15 (min)	5 (min)

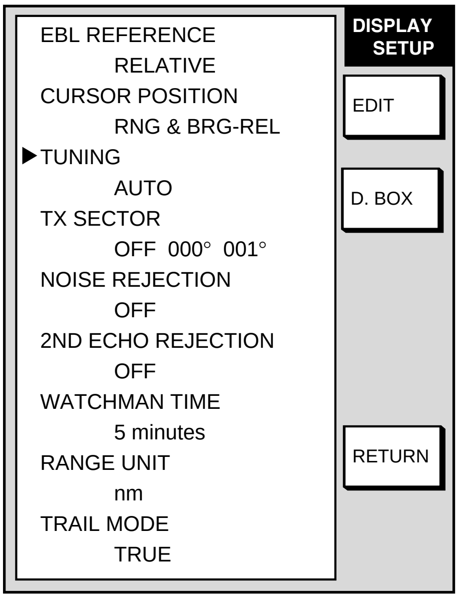
5.2 Radar Setup

This paragraph explains how to customize the radar display to suit your operational needs.

5.2.1 Radar display setup

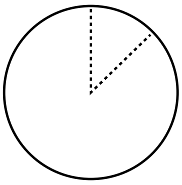
The radar display may be set up from the RADAR DISPLAY SETUP menu, which contains items such as EBL reference and cursor position format.

1. Press the [MENU] key to show the main menu.
2. Press the RADAR DISPLAY SETUP soft key.



Radar display setup menu

Contents of radar display setup menu

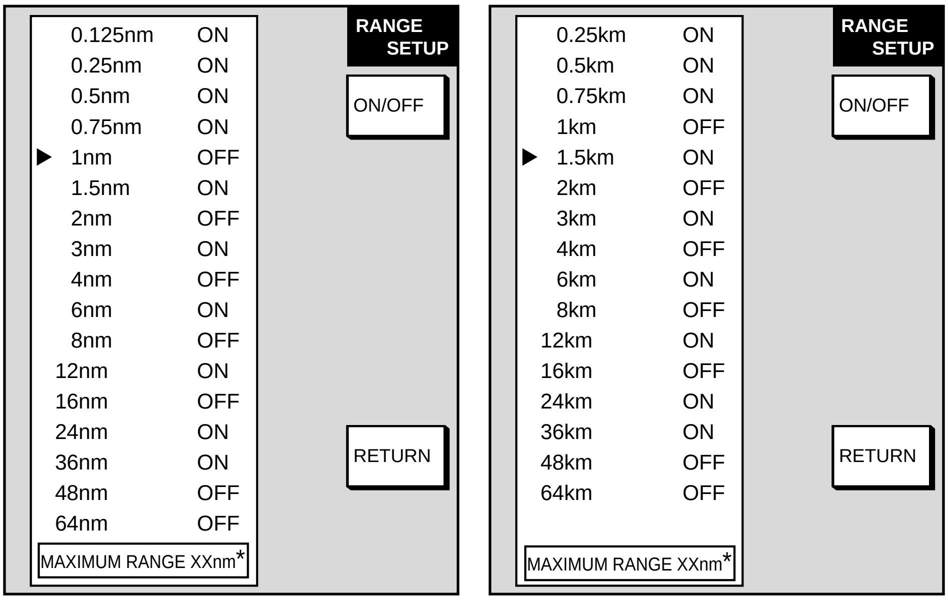
Item	Description	Settings	Default Setting
EBL Reference	References EBL bearing, shown in the EBL data box, to North (True) or heading (Relative). Relative with no heading input. True only in course-up, north-up and true motion.	True, Relative	Relative
Cursor Position	Chooses how to display cursor position. **Note:** "RNG & BRG-TRUE" requires heading data and true bearing. The equipment reverts to relative bearing when heading data is lost.	L/L: Lat/Long position of cursor TD: Loran C or Decca TDs RNG & BRG-REL: Range and bearing in relative bearing. RNG & BRG-TRUE: Range and bearing in true bearing.	RNG & BRG-REL
Tuning	Selects receiver tuning method. For further details see "2.6 Tuning."	Auto, Manual	Auto
TX Sector Blanking	Turns on/off dead sector graphic, which shows area where no echoes are transmitted. To set sector, select ON, then enter range. Max sector is 135°. The dead sector is shown with dashed lines.  *Dead sector*	On, Off	Off (0°)
Noise Rejection	Electrical noise, appearing on the screen as "speckles," may be suppressed with the noise rejector. Note that some forms of interference cannot be suppressed.	On, Off	Off
2nd Echo Rejection	Reduces second-trace echoes. See the paragraph "2.24 Suppressing Second-trace Echoes."	On, Off	Off
Watchman Time	Sets watchman stand-by period. For further details see the paragraph "2.23 Watchman."	5, 10, 20 minutes	5 minutes
Range Unit	Selects unit of range measurement.	nm, km, sm	nm
Trail Mode	Sets echo trail reference. **Note:** Relative trail is available in all presentation modes except true motion. True trail is available in all modes.	**True:** Echo trails plotted in their actual speeds and courses. Requires compass signal and speed input. **Relative:** Echo trails move relative to own ship.	Relative

5.2.2 Radar range setup

You may choose the radar ranges you wish to use, from the RADAR RANGE SETUP menu. After choosing the ranges desired, change the range with the [RANGE] key to activate range settings. Available ranges depends on the radar used.

At least two ranges (excluding maximum range) must be turned on. When less than two ranges are turned on, you cannot escape from the RADAR RANGE SETUP menu.

1. Press the [MENU] key to show the main menu.
2. Press the RADAR RANGE SETUP soft key to show the RADAR RANGE SETUP menu.



* = Max. range depends on network radar used and is set on the network radar at installation.

Range unit: nm   Range unit: km

Radar range setup menu

3. Use the trackball to select the range which you want to turn on or off.
4. Press the ON/OFF soft key to turn a range on or off as appropriate.
5. Press the RETURN soft key to register settings.
6. Press the [MENU] key to close the menu.

Model	Maximum Range
1833	36 nm, km, sm
1933	48 nm, km, sm
1943	64 nm, km, sm

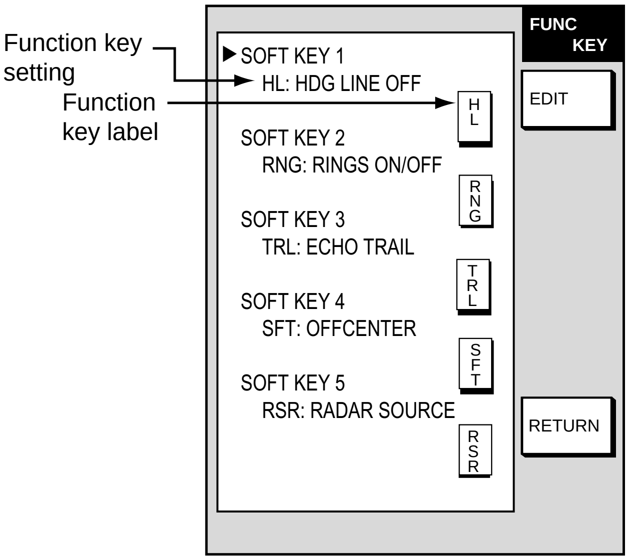
5.2.3 Function key setup

The function keys provide one-touch execution of a desired function. The default radar function key settings are as shown in the table below.

Function Key	Default Function	Function Key Label
1	Turn heading line off.	HL
2	Turn range rings on/off.	RNG
3	Turn echo trail on/off.	TRL
4	Turn display offcenter on/off.	SFT
5	Select radar source.	RSR

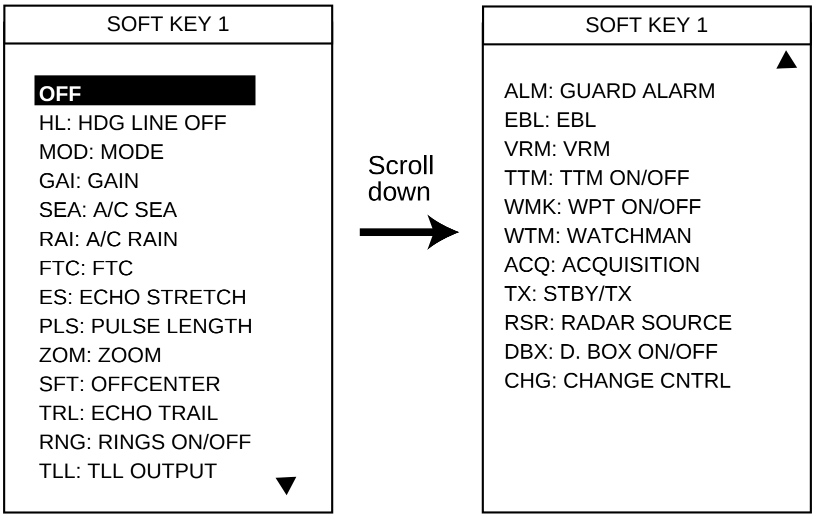
If the above settings are not to your liking you may change them as follows:

1. Press the [MENU] key.
2. Press the FUNCTION KEY SETUP soft key.



Radar function key

3. Select the function key you want to program, then press the EDIT soft key.



Radar function key options

4. Select function desired with the trackball, then press the ENTER soft key or [ENTER] knob to register your selection.
5. Press the [MENU] key to close the menu.

Radar function keys

Menu Item	Function	Function Key Label
OFF	Assigns no function.	—
HL: HDG LINE OFF	Turns heading line off.	HL
MOD: MODE	Selects presentation mode.	MOD
GAI: GAIN	Shows gain sensitivity adjustment window.	GAI
SEA: A/C SEA	Shows A/C SEA adjustment window.	SEA
RAI: A/C RAIN	Shows A/C RAIN adjustment window.	RAI
FTC: FTC	Not used.	FTC
ES: ECHO STRETCH	Turns echo stretch on/off.	ES
PLS: PULSE LENGTH	Sets pulselength (long or short).	PLS
ZOM: ZOOM	Turns zoom on/off.	ZOM
SFT: OFFCENTER	Press to shift display center to cursor location. Press again to turn shift off and return cursor to display center.	SFT
TRL: ECHO TRAIL	Starts/stops echo trails.	TRL
RNG: RINGS ON/OFF	Turns range rings on/off.	RNG
TLL: TLL OUTPUT	Outputs cursor position, in NMEA format, to navigator.	TLL
ALM: GUARD ALARM	Displays alarm soft keys.	ALM
EBL: EBL	Switches control between EBL1 and EBL2 with each press.	EBL
VRM: VRM	Switches control between VRM1and VRM2 with each press.	VRM
TTM: ON/OFF	Turns TTM (Tracked Target Message) data on/off.	TTM
WMK: WPT ON/OFF	Turns waypoint marker on/off.	WMK
WTM: WATCHMAN	Turns watchman on/off.	WTM
ACQ: ACQUISITION	Acquires and tracks cursor-selected target. (Requires ARP-equipped Model 1800/1900 series network radar.)	ACQ
TX: STBY/TX	Toggles between standby and transmit	TX
RSR: RADAR SOURCE	Selects source for radar picture.	RSR
DBX: D. BOX ON/OFF	Turns data boxes on/off.	DBX
CHG: CHANGE CNTRL	Changes display control in combination display.	CHG

Note: To use CHANGE CNTRL set it on all displays, with the same soft key number.

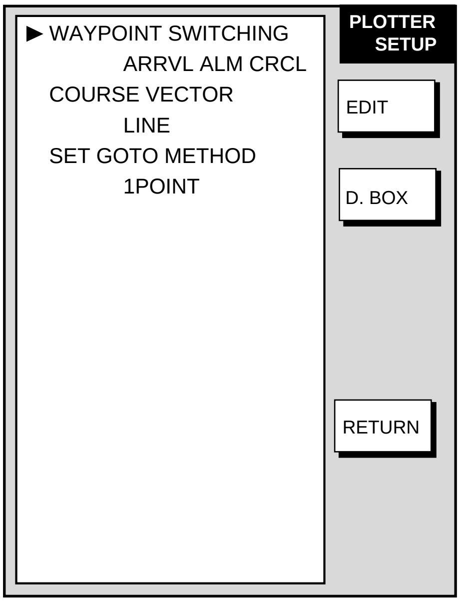
5.3 Plotter Setup

This paragraph provides the information necessary for setting up the plotter display.

5.3.1 Navigation options

Navigation options, for example, waypoint switching method, may be set on the PLOTTER SETUP menu.

1. Show the plotter display, then press the [MENU] key open the main menu.
2. Press the PLOTTER SETUP soft key.



Plotter setup menu

Contents of plotter setup menu

Item	Description	Settings	Default Setting
Waypoint Switching	Chooses waypoint switching method. See “Switching waypoints” on page 3-50.	Perpendicular, Arrvl Alm Crcl, Manual	Arrvl Alm Crcl
Course Vector	You may extend a line from the own ship position to show ship’s course. It may be a vector (length depends on ship’s speed) or a simple line (course bar).	Line, Vector, Off	Line
Set GOTO Method	Sets the method by which to navigate to a quick point. See paragraph “3.10.1 Navigating to a quick point.”	1 Point, 35 Points, 35Pts/Port SVC	1 Point
D. BOX (soft key)	Sets up data boxes. See “paragraph 5.5.”		

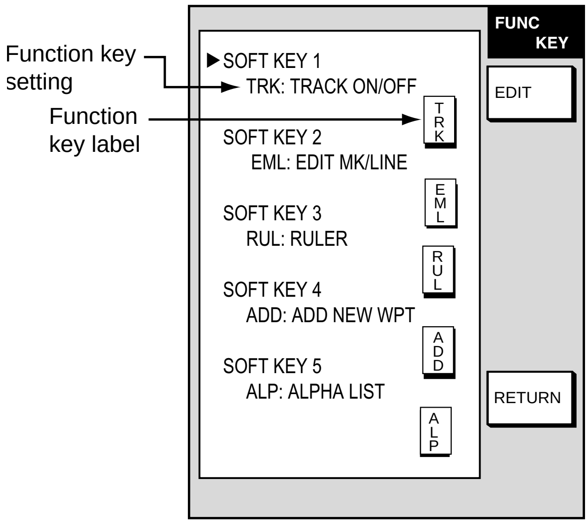
5.3.2 Function key setup

The function keys provide one-touch execution of a desired function. The default plotter function key settings are

Function Key	Default Function	Function Key Label
1	Start/stop recording/plotting own ship's track.	TRK
2	Edit mark/line.	EML
3	Ruler (measure range and bearing between two points).	RUL
4	Add new waypoint.	ADD
5	Alphanumeric waypoint list.	APL

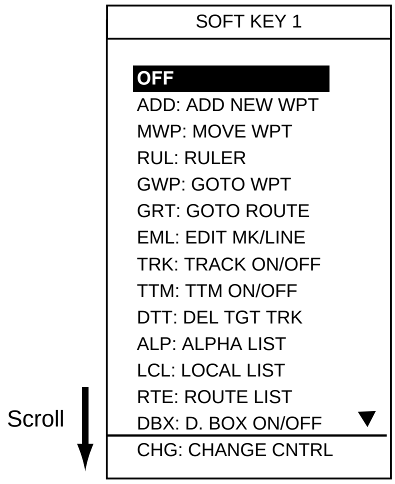
If the above settings are not to your liking you may change them as follows:

1. Press the [MENU] key.
2. Press the FUNCTION KEY SETUP soft key.



Plotter function key menu

3. Select the soft key you want to program, then press the EDIT soft key. A menu shows the functions available and the current selection is highlighted.



Plotter function key options

4. Select function desired with the trackball, then press the ENTER soft key or [ENTER] knob to register your selection.
5. Press the [MENU] key to close the menu.

Plotter function keys

Menu Item	Function	Function Key Label
OFF	Assigns no function.	—
ADD: ADD NEW WPT	Registers waypoint at cursor position. Place cursor for waypoint location then press function key.	ADD
MWP: MOVE WPT	Moves selected waypoint to different position. Select waypoint, press function key, move waypoint, then push [ENTER] knob.	MWP
RUL: RULER	Measures range and bearing between two points. Set cursor on location, then read range and bearing at top of screen. To change origin point, press START POINT soft key.	RUL
GWP: GOTO WPT	Specify waypoint to set as destination. Enter waypoint name in window, then press the ENTER soft key.	GWP
GRT: GOTO ROUTE	Specify route to follow. Enter route name in window, then press the ENTER soft key.	GRT
EML: EDIT MK/LINE	Displays mark & line menu. Press appropriate soft key to access menu item.	EML
TRK: TRACK ON/OFF	Each press starts or stops recording/plotting own ship’s track.	TRK
TTM: TTM ON/OFF	Turns TTM (Target Track Message) display on/off.	TTM
DTT: DEL TGT TRACK	Erases all TTM track.	DTT
ALP: ALPHA LIST	Displays waypoint alphanumeric list.	ALP
LCL: LOCAL LIST	Displays waypoint local list.	LCL
RTE: ROUTE LIST	Displays route list.	RTE
DBX: D. BOX ON/OFF	Shows/hides data boxes.	DBX
CHG: CHANGE CNTRL	Changes control in combination screen.	CHG

Note: To use CHANGE CNTRL set it on all displays, with the same soft key number.

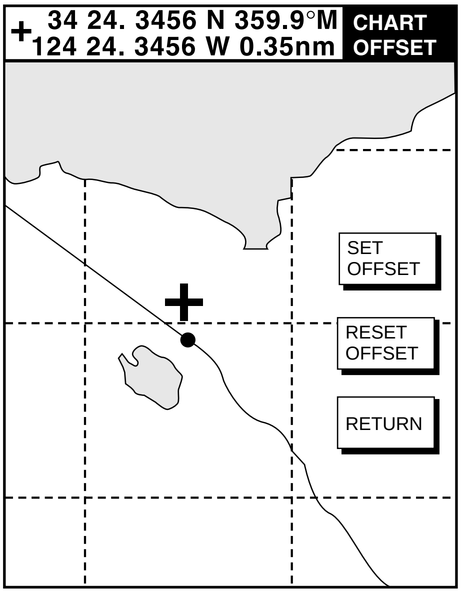
5.4 Chart Setup

This paragraph shows you how to setup digital charts, from offsetting chart position to turning chart attributes on or off.

5.4.1 Chart offset

In some instances position may be off by a few seconds. For example, the position of the ship is shown to be at sea while it is in fact moored at a pier. You can compensate for this error by offsetting chart position as shown in the procedure below.

1. Show the plotter display, then press the [MENU] key followed by the CHART SETUP and CHART OFFSET soft keys.



Plotter display, chart offset selected

2. Use the trackball to place the cursor at the correct latitude and longitude position of own ship.
3. Press the SET OFFSET soft key.
4. Press the [MENU] key to close the menu. The “chart offset icon” () appears.

To cancel chart offset, press the RESET OFFSET soft key at step 3 in the above procedure.

5.4.2 FURUNO, NavCharts™ chart attributes

FURUNO, NavCharts™ chart attributes may be turned on or off from the CHART DETAILS menu, which you may display as follows:

1. Press the [MENU] key.
2. Press the CHART SETUP and CHART DETAILS soft keys.

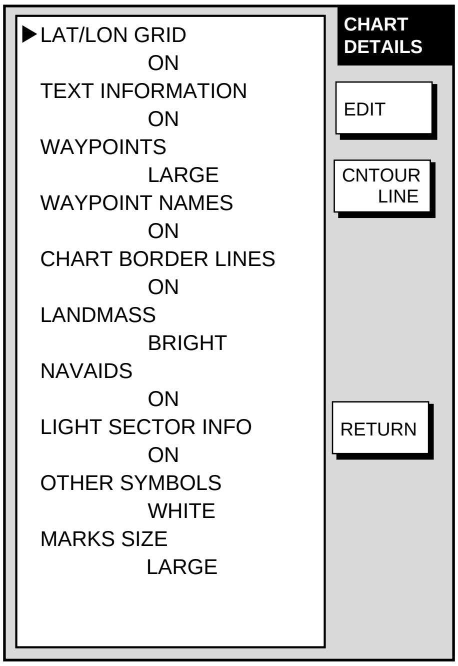


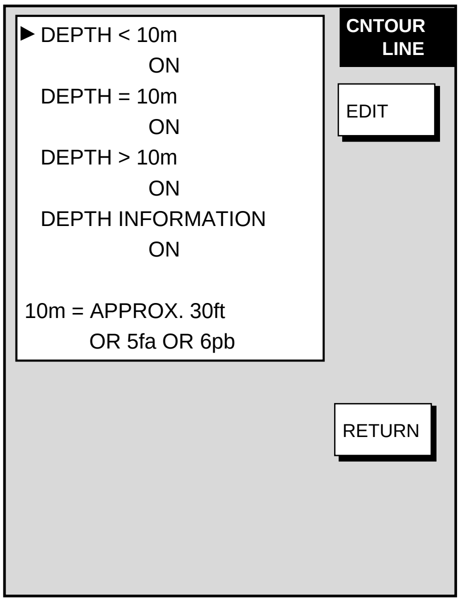
Chart details menu (FURUNO, NavCharts™)

Contents of chart details menu (FURUNO, NavCharts™)

Item	Description	Settings	Default Setting
Lat/Lon Grid	Latitude and longitude grids	On, Off	On
Text Information	Geographic place, name	On, Off	On
Waypoints	Waypoint size	Large, Small, Off	Large
Waypoint Names	Waypoint name	On, Off	On
Chart Border Lines	Border lines (indices)	On, Off	On
Landmass	Landmass brilliance	Bright, Dim, Off	Bright
Navaids	Navaid data on NavCharts™; lighthouse data on FURUNO charts	On, Off	On
Light Sector Info	Lighthouse viewing sector	On, Off	On
Other Symbols	Other map symbols	On, Off	On
Marks Size	Mark size	Large, Small	Large
CNTOUR LINE soft key (See next page.)	Depth < 10 m	On, Off	On
	Depth = 10 m	On, Off	On
	Depth > 10 m	On, Off	On
	Depth Information	On, Off	On

CNTOUR LINE soft key

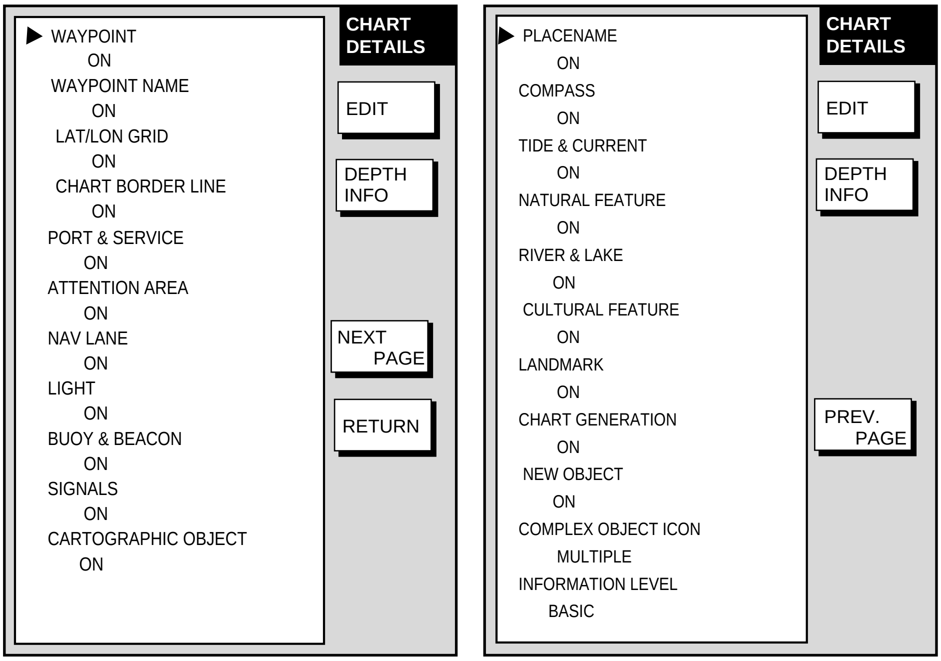
1. Press the [MENU] key.
2. Press the CHART SETUP and CHART DETAILS soft keys.
3. Press the CNTOUR LINE soft key.



Contour line menu (FURUNO, NavCharts™)

5.4.3 C-MAP chart attributes

C-MAP chart attributes may be turned on or off from the CHART DETAILS menu, which you may display by pressing the [MENU] key followed by the CHART SETUP and CHART DETAILS soft keys.



Page 1 Page 2

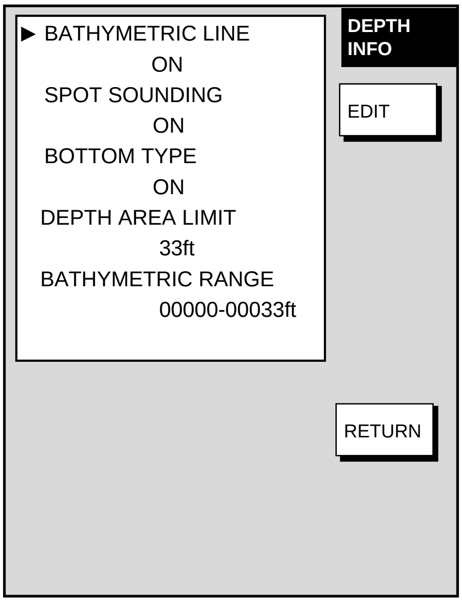
Chart details menu (C-MAP)

Contents of chart details menu (C-MAP)

Item	Description	Settings	Default Setting
Waypoint	Waypoint display	On, Off	On
Waypoint Name	Waypoint name	On, Off	On
Lat/Lon Grid	Latitude and longitude grids	On, Off	On
Chart Border Line	Border lines (indices)	On, Off	On
Port & Service	Port services icon display	On, Off	On
Attention Area	Attention area icon display	On, Contour, Off	On
Nav Lane	Navigation lanes	On, Off	On
Light	Lighthouse icon, sector	On, No Sector, Off	On
Buoy & Beacon	Buoys, beacons display	On, Off	On
Signal	Signals category icon	On, Off	On
Cartographic Object	Cartographic objects category icon	On, Off	On
Place Name	Geographic names	On, Off	On
Compass	Compass category icons	On, Off	On
Tide & Current	Tide display	On, Off	On
Natural Feature	Land outline	On, Off	On
River & Lake	Rivers and lakes	On, Off	On
Cultural Feature	Cultural features icons	On, Off	On
Landmark	Landmarks category icons	On, Off	On
Chart Generation	Chart generation category icons	On, Off	On
New Object	New object category icons	On, Off	On
Complex Object Icon	Single or multiple icon for object composed of several icons	Multiple, Single	Multiple
Information Level	Basic or detailed data for objects	Basic, Detailed	Basic
DEPTH INFO soft key (See next page.)	Bathymetric Line	On, Off	On
	Spot Sounding	On, Off	On
	Bottom Type	On, Off	On
	Depth Area Limit	0-99999 ft (m, fa, P/B)	33 ft (10 m, 6 fa, 6 P/B)
	Bathymetric Range	0-99999 ft (m, fa, P/B)	0-30 ft (0-10 m, 0-6 fa, 0-6 P/B)

DEPTH INFO soft key

1. Press the [MENU] key.
2. Press the CHART SETUP and CHART DETAILS soft keys.
3. Press the DEPTH INFO soft key.



Depth info menu (C-MAP)

5.5 Data Boxes Setup

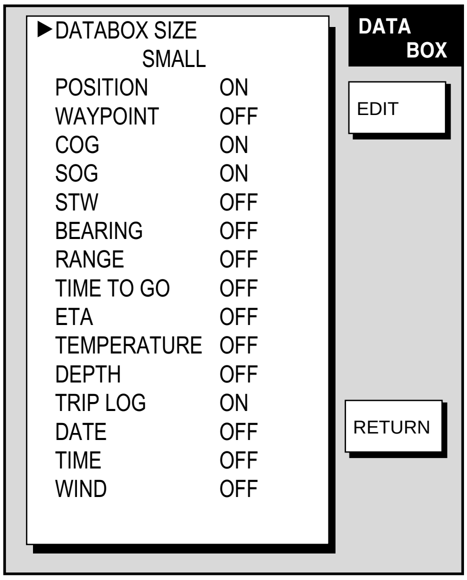
You may select the data to show in the data boxes for the plotter, radar and sounder displays. Six boxes may be displayed in case of small size data box and two for large size data box.

1. Display the radar, plotter or sounder display, whichever you want to set.
2. Press the [MENU] key to open the main menu.
3. Press one of the following sets of soft keys depending on the display selected at step 1.

   Plotter mode: PLOTTER SETUP, D. BOX

   Radar mode: RADAR DISPLAY SETUP, D. BOX

   Sounder mode: SOUNDER MENU, D. BOX



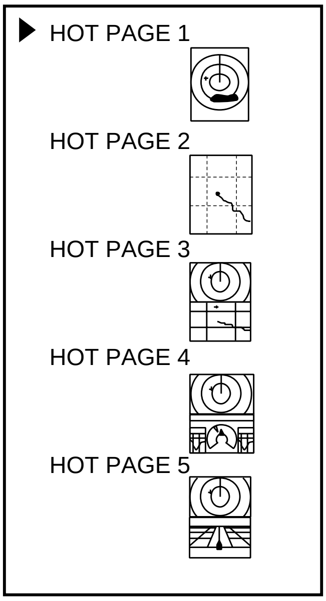
Data box menu

4. Use the trackball to select an item, then press the EDIT soft key.
5. Select ON or OFF as desired.
6. Press the ENTER soft key or the [ENTER] knob to register your selection.
7. Repeat steps 4-6 to turn other items on or off.
8. Press the [MENU] key to close the menu.

5.6 Hot Page Setup

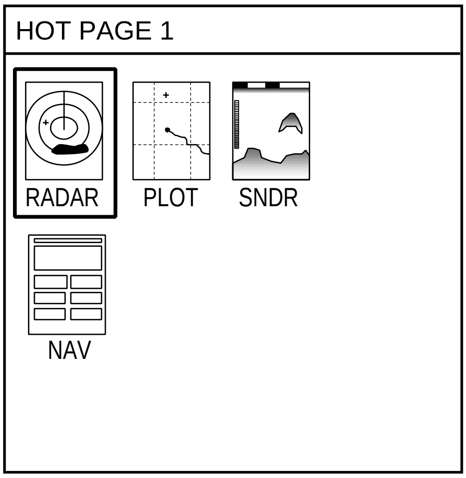
Five user-arrangeable hot pages are provided for quick selection of desired display.

1. Press the [MENU] key followed by pressing the SYSTEM CONFIGURATION, SYSTEM SETUP, HOT PAGE & NAV DISP SETUP and HOT PAGE SETUP soft keys in that order.



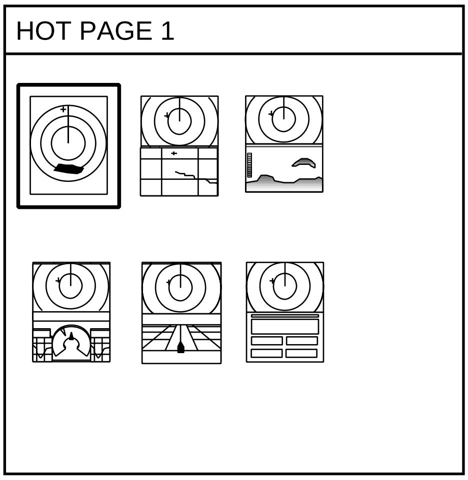
Hot page setup screen, page 1

2. Use the trackball to select the hot page number to set, then press the EDIT soft key.



Hot page setup screen, page 2

3. Use the trackball to select a screen, then press the [ENTER] knob. A screen with mostly combination displays appears. The example below shows the displays available with radar.



Hot page setup screen, page 3

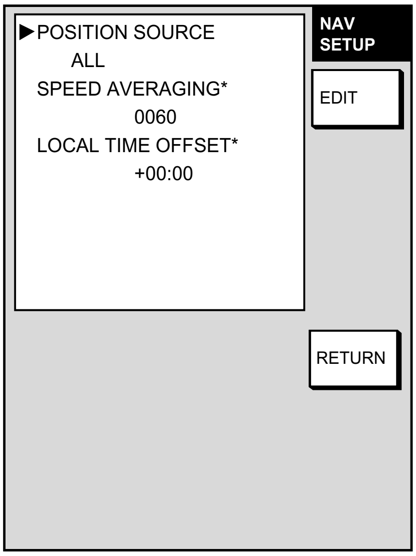
4. Rotate the [ENTER] knob to select screen desired, then press the [ENTER] knob.
5. Press the [MENU] key to close the menu.

5.7 Navigator Setup

This section provides the information necessary for selecting the type of navigator connected to your plotter.

5.7.1 Navigation data source

The NAV SETUP menu mainly selects the source of nav data. For GPS receiver other than the GP-310B speed averaging and local time offset (to use local time) are also available. Press the [MENU] key followed by the SYSTEM CONFIGURATION, NAV OPTION and NAV SOURCE SETTINGS soft keys to display this menu.



* For GPS receiver other than GP-310B.

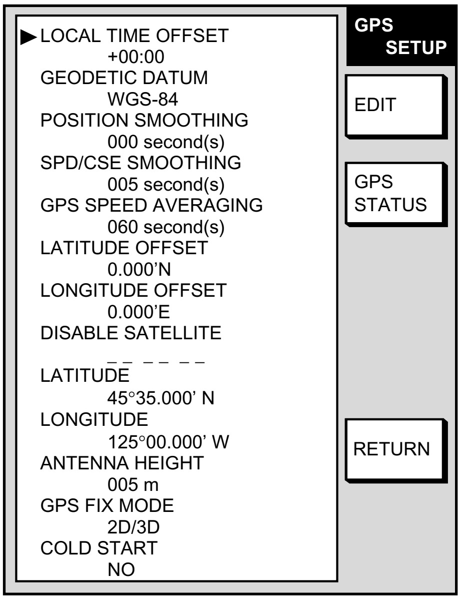
Nav setup menu

Contents of nav setup menu

Item	Description	Settings	Default Setting
Position Source	Chooses source of position data.	**FURUNO BB GPS:** GPS Receiver GP-310B **GP:** GPS navigator (via NETWORK or NMEA port) **LC:** Loran C navigator (via NETWORK or NMEA port) **ALL:** Multiple navaid connection (via NETWORK or NMEA port)	ALL
Speed Averaging	Calculation of ETA is based on average ship's speed over a given period. If the period is too long or too short, calculation error will result. Change this setting if calculation error occurs.	0-9999 seconds	60 seconds
Local Time Offset	GPS uses UTC time. If you would rather use local time, enter the time difference between it and UTC. Use the +< - ->- soft key to switch from plus to minus and vice versa.	-13:30 to +13:30 hours	00:00
Temp Calibration	Offsets NMEA water temperature data.	-40°F - +40°F	0°F
Depth Calibration	Offsets NMEA depth data.	-15 - +90 ft	0 ft

5.7.2 GPS receiver setup

The GPS SETUP menu sets up the GPS Receiver GPS-310B. Press the [MENU] key followed by the SYSTEM CONFIGURATION, NAV OPTION and GPS SENSOR SETTINGS soft keys to display this menu.



GPS setup menu

Contents of GPS setup menu

Item	Description	Settings	Default Setting
Local Time Offset	GPS uses UTC time. If you would rather use local time, enter the time difference between it and UTC. Use the +< - ->- soft key to switch from plus to minus and vice versa.	-13:30 to +13:30 hours	00:00
Geodetic Datum	Geodetic datum is a reference for geodetic survey measurements consisting of fixed latitude, longitude and azimuth values associated with a defined station of reference. You must have the correct geodetic datum selected in your plotter so that it will reference the correct point on the chart for a given latitude and longitude. Although WGS-84 is now the world standard, other categories of charts still exist. Refer to Appendix for a full list of geodetic datum.	See Appendix for full list.	WGS-84

(Con't on next page)

Contents of GPS setup menu (con’t from previous page)

Item	Description	Settings	Default Setting
Position Smoothing	When the DOP or receiving condition is unfavorable, the GPS fix may change greatly, even if the vessel is not moving. This change can be reduced by smoothing the raw GPS fixes. A setting between 000 to 999 is available. The higher the setting the more smoothed the raw data. If the setting is too high, the response time required to show a change of latitude and longitude will be too long. This is especially noticeable if the vessel is moving fast. Increase the setting if the GPS fix changes randomly.	0-999 seconds	0 seconds (no position smoothing)
Spd/Cse Smoothing	During position fixing, ship’s velocity (speed and course) is directly measured by receiving GPS satellite signals. The raw velocity data may vary too much depending on receiving conditions and other factors. You can reduce this random variance by increasing the smoothing. The higher the smoothing setting, the more the raw data will be averaged. If this setting is high, the response to speed and course changes will slow. For no smoothing, enter all zeroes.	0-999 seconds	5 seconds
GPS Speed Averaging	Calculation of ETA is based on average ship’s speed over a given period. If the period is too long or too short, calculation error will result. Change this setting if calculation error occurs. The default setting is suitable for most conditions.	0-9999 seconds	60 seconds
Latitude Offset	Offsets latitude position to further refine position accuracy. Use the N < - - > S soft key to switch coordinate.	9.999’S – 9.999’N	0.0’ (no offset)
Longitude Offset	As above but for longitude. Use the W < - - > E soft key to switch coordinate.	9.999’E – 9.999’W	0.0’ (no offset)

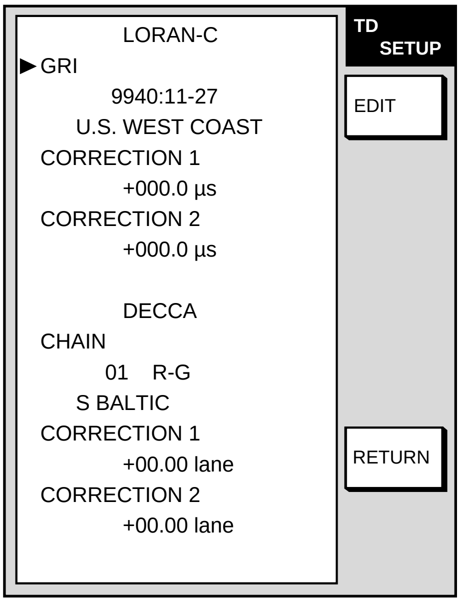
(Con’t on next page)

Contents of GPS sensor settings menu (con't from previous page)

Item	Description	Settings	Default Setting
Disable Satellite	Every GPS satellite is broadcasting abnormal satellite number(s) in its Almanac, which contains general orbital data about all GPS satellites, including those which are malfunctioning. Using this information, the GPS receiver automatically eliminates any malfunctioning satellite from the GPS satellite schedule. However, the Almanac sometimes may not contain this information. If you hear about a malfunctioning satellite from another source, you can disable it manually. Enter satellite number (two digits, max. 3 satellites), then press the ENTER soft key.	Max. 3 satellites	None
Latitude	Sets initial latitude position after cold start. Use the N < - - > S soft key to switch coordinate.	—	45°35'N
Longitude	Sets initial longitude position after cold start. Use the W < - - > E soft key to switch coordinate.	—	125°00'W
Antenna Height	Enters the height of the GPS antenna unit above sea surface. For further details refer to the installation manual.	0-99 m	5 m
GPS Fix Mode	Chooses position fixing method: 2D (three satellites in view), 2D/3D (three or four satellites in view whichever is greater).	2D, 2D/3D	2D/3D
Cold Start	Clears the Almanac to receive the latest Almanac.	No, Yes	No
GPS STATUS (soft key)	Displays GPS satellite status display. Requires GPS Receiver GP-310B or GPS navigator outputting the data sentence GSA or GSV. For further details see the chapter on Maintenance.		

5.7.3 TD display setup

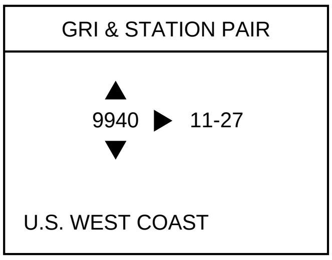
The TD SETUP menu sets which Loran C or Decca chain to use to display TD position. (Connection of a Loran C or Decca navigator is not necessary to display TD position.) Press the [MENU] key followed by the SYSTEM CONFIGURATION, NAV OPTION and TD SETUP soft keys to display this menu.



TD setup menu

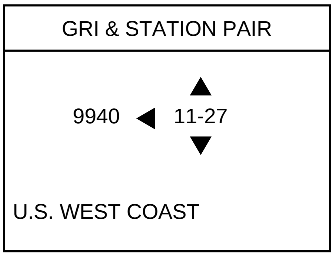
Displaying Loran C TDs

1. Select GRI, then press the EDIT soft key to show the GRI & station pair window.



Loran GRI & station pair window

2. Adjust the trackball upward or downward to select GRI code.
3. Roll the trackball rightward to show the display below, to enable selection of station pair.



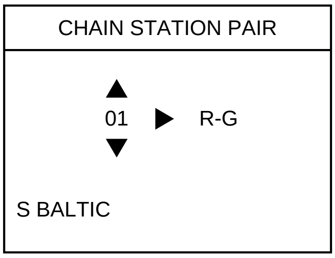
Loran C GRI & station pair window

4. Adjust the trackball vertically to select station pair.

5. Press the ENTER soft key to register your selection.
6. If necessary, you may enter a position offset to refine Loran C position accuracy. Select (GRI) CORRECTION 1 or CORRECTION 2, then press the EDIT soft key. Enter correction value with the trackball and [ENTER] knob. Use the + < – –> - soft key to switch from plus to minus and vice versa. Press the ENTER soft key or push the [ENTER] knob.
7. Press the RETURN soft key twice.
8. Press the GENERAL SETUP soft key followed by the NEXT PAGE soft key.
9. Select “LORAN C” from “TD DISPLAY” and “TD” from “POSITION DISPLAY.”
10. Press the [MENU] key twice to close the menu.

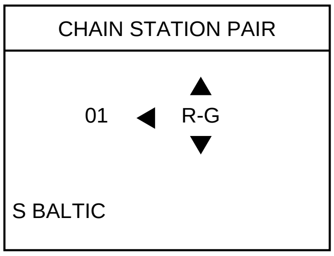
Displaying DECCA TDs

1. Select CHAIN, then press the EDIT soft key to show the chain & station pair window.



Decca chain and station pair window

2. Adjust the trackball upward or downward to select Decca chain number.
3. Roll the trackball rightward to show the display below, to enable selection of station pair.



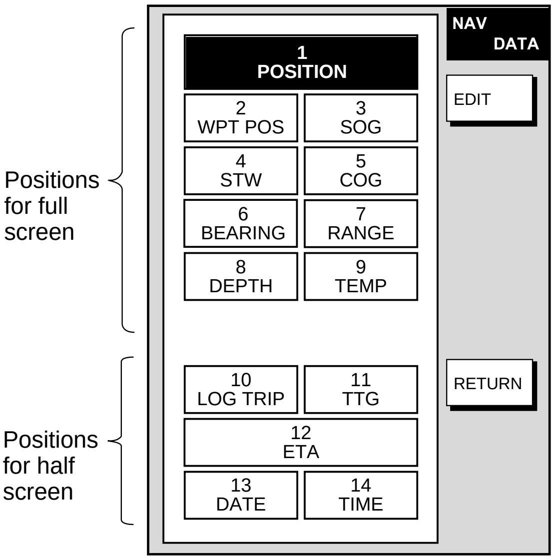
Decca chain and station pair window

4. Adjust the trackball upward or downward to select station pair (R: red, G: green and P: purple).
5. Press the ENTER soft key to register your selection.
6. If necessary, you may enter position offset to refine Decca position. Select (CHAIN) CORRECTION 1 or CORRECTION 2, then press the EDIT soft key. Enter correction value with the trackball and [ENTER] knob. Use the + < – –> - soft key to switch from plus to minus and vice versa. Press the ENTER soft key or push the [ENTER] knob.
7. Press the RETURN soft key twice.
8. Press the GENERAL SETUP soft key followed by the NEXT PAGE soft key.
9. Select “DECCA” from “TD DISPLAY” and “TD” from “POSITION DISPLAY.”
10. Press the [MENU] key twice to close the menu.

5.8 Nav Data Display Setup

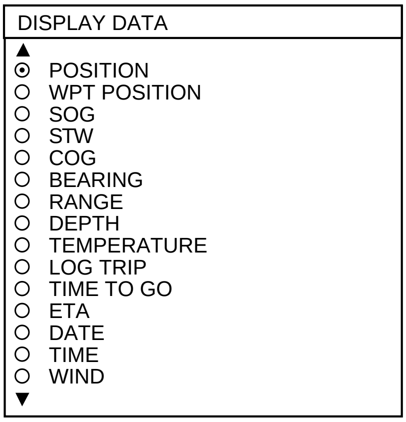
The nav data display shows various navigation data, fed from a navigator, network equipment, etc. You may select the data to display and where to display it as follows:

1. Press the [MENU] key to open the main menu.
2. Press the SYSTEM CONFIGURATION, SYSTEM SETUP, HOT PAGE & NAV DISP SETUP and NAV DATA DISPLAY SETUP soft keys.



Nav data setup screen

3. Use the trackball to select a location. Locations 1-9 are for the full-screen nav data display and positions 10-14 for the half-screen nav data display.
4. Press the EDIT soft key. The following display appears.



Nav data setup window

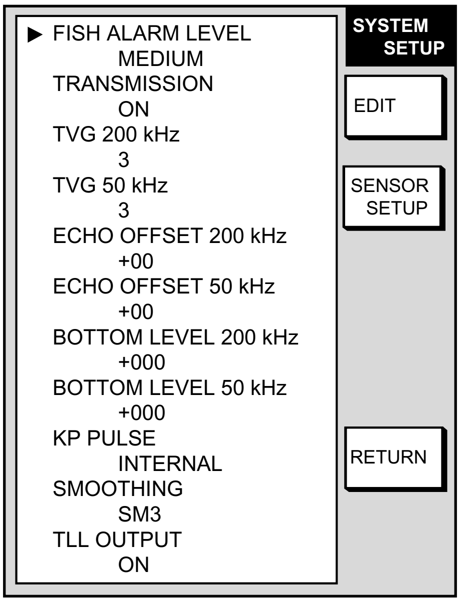
5. Select the data to display, then press the ENTER soft key or [ENTER] knob to register your selection.
6. Press the RETURN soft key followed by the [MENU] key to close the menu.

5.9 Sounder Setup

This section shows you how to customize your network sounder to your liking. You can set fish alarm sensitivity, fine tune sensors, etc.

5.9.1 System setup

1. Show the sounder display, then press the [MENU] key.
2. Press the SOUNDER SYSTEM SETUP soft key.



Sounder system setup menu

Sounder system setup menu description

Item	Description	Settings	Default Setting
Fish Alarm Level	Sets the fish alarm sensitivity; that is, the minimum echo strength which will trigger the fish alarms.	**High:** Strongest echoes trigger the alarm. **Medium:** Strong-to-medium-strength-echoes trigger the alarm. **Low:** Any echo triggers the alarm.	Medium
Transmission	Turns TX power on/off.	On, Off	On

(Continued on next page)

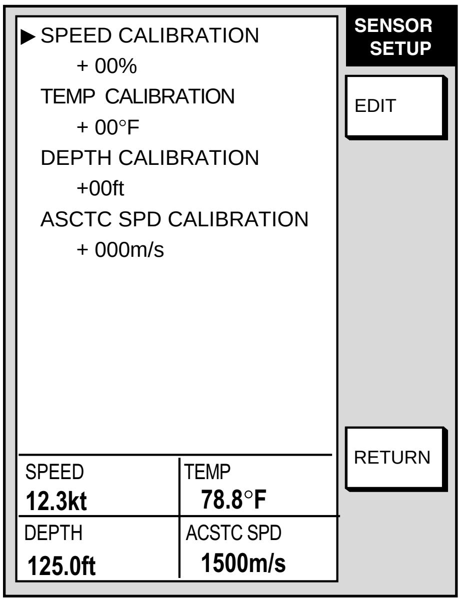
Sounder system setup menu description (con't from previous page)

Item	Description	Settings	Default Setting
TVG (50 kHz, 200 kHz)	TVG (Time Varied Gain) compensates for propagation attenuation of the ultrasonic waves. It does this by equalizing echo presentation so that fish schools of the same size appear in the same density in both shallow and deep waters. In addition, it reduces surface noise. Note that if the TVG level is set too high short range echoes may not be displayed.	0-9	3 (both 50 kHz and 200 kHz)
Echo Offset (50 kHz, 200 kHz)	If the on-screen echo level appears to be too weak or too strong and the level cannot be adjusted satisfactorily with the gain control, adjust echo offset to compensate for too weak or too strong echoes.	-50 - +50	0 (both 50 kHz and 200 kHz)
Bottom Level (50 kHz, 200 kHz)	If the depth indication is unstable in automatic operation or the bottom echo cannot be displayed in the darkest tone by adjusting the gain control in manual operation, you may adjust the bottom echo level detection circuit, for both 50 kHz and 200 kHz, to stabilize the indication. Note that if the level is set too low weak echoes may be missed and if set too high the depth indication will not be displayed.	-100 - +100	0 (both 50 kHz and 200 kHz)
KP Pulse	Selects source of keying pulse. (See installation manual.)	Internal, External	Internal
Smoothing	Smoothes echoes to present stable display. The higher the setting the greater the smoothing.	SM1-SM4, OFF	SM3
TLL Output	Outputs current position to plotter where it is marked with TLL mark. Use a soft key to output TLL.	ON, OFF	ON
SENSOR SETUP soft key	Offsets speed, depth, water temperature indications and speed of sound.	See next section for details.	

5.9.2 Sensor setup

The SENSOR SETUP menu lets you further refine speed, water temperature and depth data fed from the network sounder.

1. Show the sounder display, then press the [MENU] key.
2. Press the SOUNDER SYSTEM SETUP and SENSOR SETUP soft keys to show the SENSOR SETUP menu. The current ship's speed, water temperature, depth and speed of sound are shown at the bottom of the menu.



Sensor setup menu

3. Select item to adjust, then press the EDIT soft key.
4. Adjust the trackball upward or downward to set appropriate value.

   Speed and temperature calibrations: Enter plus or minus value. For example, if the water temperature readout is 77°F but the actual water temperature is 75°F, enter –2(°F).

   Depth calibration: If you desire the depth readout to show the distance between ship's draft and bottom (rather than transducer and bottom), set ship's draft here. Enter a plus or minus value.

   Acoustic speed calibration: Sets the speed of sound used by the network sounder. Normally no adjustment is required, however if echoes are returning too slow or too fast adjust the value as appropriate. This is only used if water salinity is at an extreme level. Under normal circumstances, do not adjust.

Sensor setup menu settings

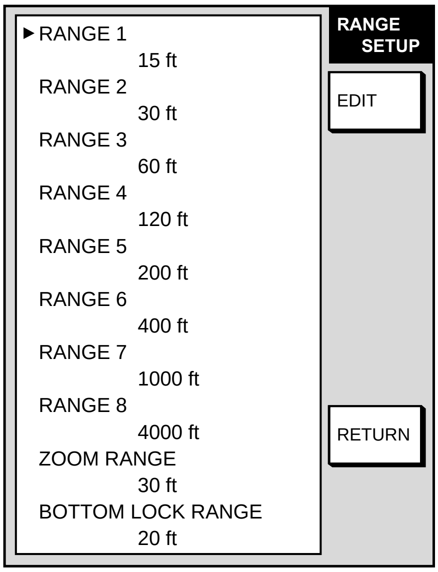
Item	Settings	Default Setting
Speed Calibration	-50 -+50%	0 (no offset)
Temperature Calibration	-40°F – +40°F	0 (no offset)
Depth Calibration	-15 - +90 ft	0 (no offset)
Acoustic Speed Calibration	-500 - +500 m/s	0 (no offset)

5. Press the RETURN soft key followed by the [MENU] key.

5.9.3 Sounding range, zoom range, bottom lock range

This paragraph shows you how to set custom ranges for basic range, zoom range (marker and bottom zoom) and bottom lock range. All default basic ranges are restored whenever the unit of depth measurement is changed. Therefore, change the depth unit before changing the basic ranges.

1. Show the sounder display, then press the [MENU] key to open the main menu.
2. Press the SOUNDER RANGE SETUP soft key to show the SOUNDER RANGE SETUP menu.



Sounder range setup menu

3. Select the range to change, then press the EDIT soft key.
4. Use the trackball to set range desired, then press the RETURN soft key. For basic range, set depth from lowest to highest; a range cannot be higher than its succeeding neighbor.
5. Press the [MENU] key to finish.

Default basic ranges

Range 1	Range 2	Range 3	Range 4	Range 5	Range 6	Range 7	Range 8
5 m	10 m	20 m	40 m	80 m	150 m	300 m	1200 m
15 ft	30 ft	60 ft	120 ft	200 ft	400 ft	1000 ft	4000 ft
3 fa	5 fa	10 fa	20 fa	40 fa	80 fa	150 fa	650 fa
3 P/B	5 P/B	10 P/B	30 P/B	50 P/B	100 P/B	200 P/B	700 P/B

Setting range: 2 m –1200 m, 7 ft – 4000 ft, 1 fa – 650 fa, 1 P/B – 700 P/B

Zoom range and bottom-lock ranges

Item	Settings	Default Setting
Zoom Range	2 m – 120 m, 7 ft – 400 ft, 1 fa – 60 fa, 1 P/B – 70 P/B	10 m, 30 ft, 10 fa, 10 P/B
Bottom-lock Range	3 or 6 m, 10 or 20 ft, 2 or 3 fa, 2 or 3 P/B	6 m, 20 ft, 3 fa, 3 P/B

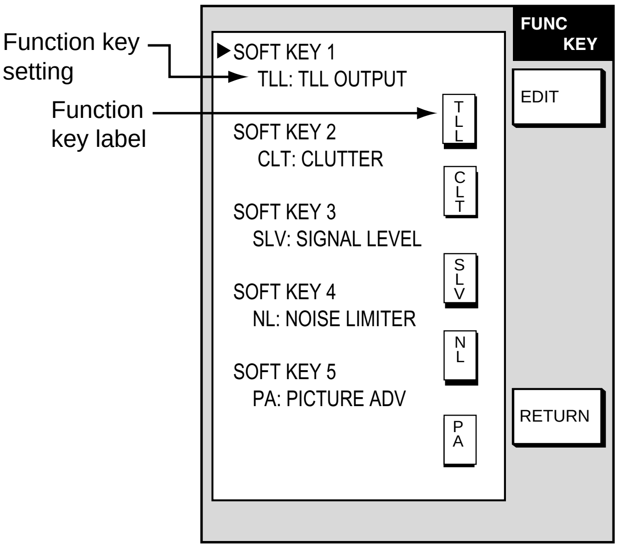
5.9.4 Function key setup

The function keys, shown when the soft keys are turned off, provide one-touch execution of a desired function. The default sounder function key settings are as shown in the table below.

Function Key	Default Function	Function Key Label
1	Output current position.	TLL
2	Suppress clutter.	CLT
3	Erase weak signal.	SLV
4	Suppress noise.	NL
5	Set picture advancement speed.	PA

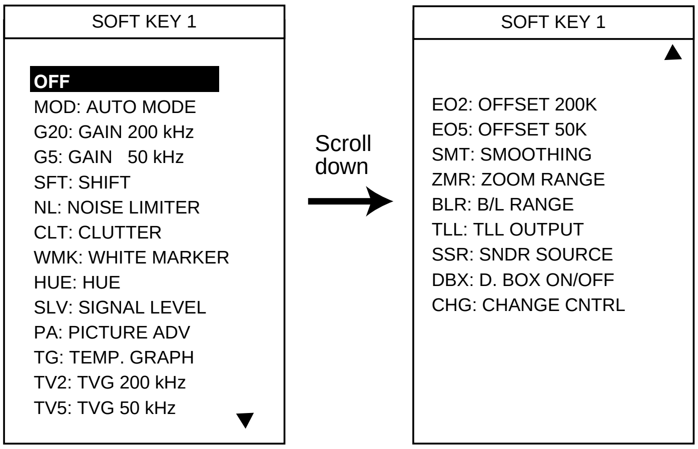
If the above settings are not to your liking you may change them as follows:

1. Show the sounder display.
2. Press the [MENU] key.
3. Press the FUNCTION KEY SETUP soft key.



Sounder function key menu

4. Select the function key you want to program, then press the EDIT soft key.



Sounder function key options

5. Select function desired with the trackball, then press the ENTER soft key or [ENTER] knob to register your selection.
6. Press the [MENU] key to close the menu.

Sounder function keys

Menu Item	Function	Function Key Label
OFF	Assigns no function.	
MOD: AUTO MODE	Display automatic mode selection window.	MOD
G20: GAIN 200 kHz	Displays 200 kHz gain adjustment window.	G20
G5: GAIN 50 kHz	Displays 50 kHz gain adjustment window.	G5
SFT: SHIFT	Shifts range in manual operation.	SFT
NL: NOISE LIMITER	Suppresses noise.	NL
CLT: CLUTTER	Suppresses clutter.	CLT
WMK: WHITE MARKER	Not used.	WMK
HUE: HUE	Not used.	HUE
SLV: SIGNAL LEVEL	Erases weak signals.	SLV
PA: PICTURE ADV	Sets picture advance speed.	PA
TG: TEMP. GRAPH	Turns temperature graph on/off.	TG
TV2: TVG 200 kHz	Sets TVG for 200 kHz.	TV2
TV5: TVG 50 kHz	Sets TVG for 50 kHz.	TV5
E02: OFFSET 200K	Offsets echo strength for 200 kHz.	EO2
E05: OFFSET 50K	Offsets echo strength for 500 kHz.	EO5
SMT: SMOOTHING	Sets echo smoothing rate.	SMZ
ZMR: ZOOM RANGE	Sets zoom range.	ZMR
BLR: B/L RANGE	Sets bottom lock range for bottom-lock display.	BLR
TLL: TLL OUTPUT	Outputs current position to plotter. Also inscribes line on sounder and registers position as a waypoint on plotter.	TLL
SSR: SNDR SOURCE	Selects source for sounder data.	SSR
DBX: D. BOX ON/OFF	Turns data boxes on/off.	DBX
CHG: CHANGE CNTRL	Switches control in combination display.	CHG

Note: To use CHANGE CNTRL set it on all displays, with the same soft key number.

6. DATA TRANSFER

This chapter provides information for saving and replaying data to and from memory cards, uploading and downloading data, loading waypoint data from Yeoman, and outputting data through the network.

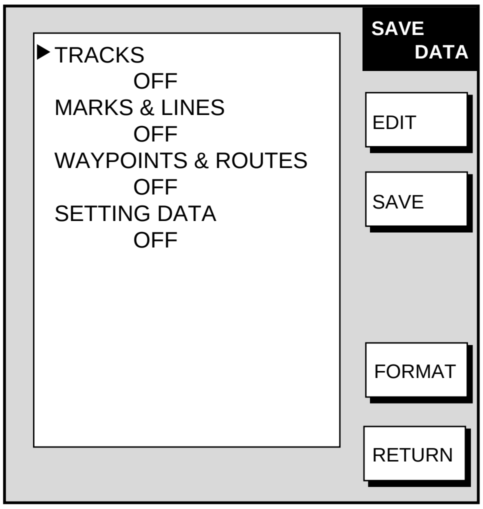
6.1 Memory Card Operations

The memory cards store these data: marks, lines, waypoints, routes, track, and setting data.

6.1.1 Formatting memory cards

Before you can use a memory card it must be formatted. This prepares the card for use with the system. Note that formatting a memory card erases all data from the card.

1. Insert a blank memory card into the card slot.
2. Press the [MENU] key followed by the SYSTEM CONFIGURATION, DATA TRANSFER, UPLOAD/DOWNLOAD DATA and SAVE DATA TO MEMORY CARD soft keys to show the SAVE DATA menu.



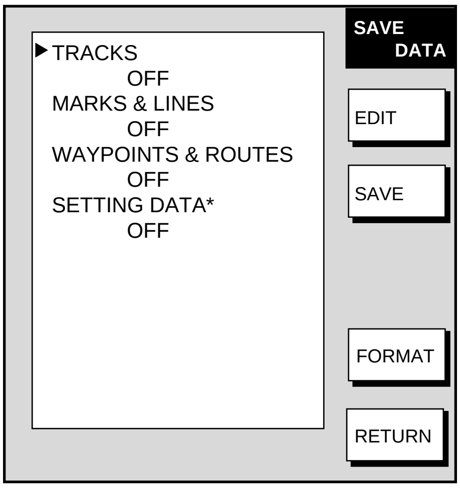
Save data menu

3. Press the FORMAT soft key. You are asked if you are ready to format the memory card.
4. Push the [ENTER] knob to format (or press the [CLEAR] key to escape). "NOW FORMATTING MEMORY CARD" appears. Do not remove the card while it is being formatting. When the formatting is completed, "FORMAT COMPLETED. PUSH ENTER KNOB TO CONTINUE." appears.
5. Push the [ENTER] knob to continue.

Note: If the memory card was not inserted correctly, the message "FAILED TO FORMAT MEMORY CARD." appears.

6.1.2 Saving data to a memory card

1. Insert a formatted memory card into the slot.
2. Press the [MENU] key followed by the CONFIGURATION, DATA TRANSFER, UPLOAD/DOWNLOAD DATA and SAVE DATA TO MEMORY CARD soft keys to show the SAVE DATA menu.



* = Plotter data only

Save data menu

3. Use the trackball to select item to save.
4. Press the EDIT soft key.
5. Use the trackball to select ON.
6. Press the ENTER soft key.
7. Repeat steps 3 to 6 to choose other data to save if desired.
8. Press the SAVE soft key, then press the [ENTER] knob. The message “NOW SAVING DATA TO MEMORY CARD. DO NOT TURN OFF DISPLAY UNIT UNTIL COMPLETED.” appears.

When saving is completed, “COMPLETED SAVING DATA. PUSH ENTER KNOB TO CONTINUE.” appears. Push the [ENTER] knob to continue.

Memory card messages

Various memory card messages appear to alert you to memory card-related error. These are tabulated below.

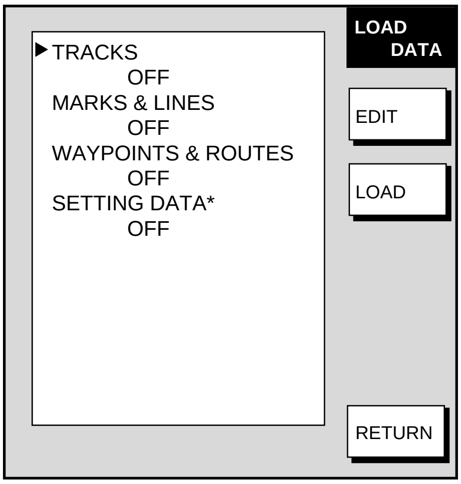
Memory card messages

Message	Reason	Remedy
Memory card is not inserted. Please insert memory card. Push ENTER knob to continue.	Memory card not inserted.	Push the [ENTER] knob to return to the SAVE DATA display and then insert card.
Memory card is not formatted. Push ENTER knob to continue.	Unformatted memory card.	Push the [ENTER] knob to return to the SAVE DATA display. Format the card referring to page 6-1.
Wrong card is inserted. Please insert correct memory card. Push ENTER knob to continue.	Chart card inserted instead of memory card.	Remove chart card, insert memory card, and then push the [ENTER] knob to continue.
Overwrite data? (Track) (Mark) (WPT) (Config)	Data type to be recorded exists on memory card. (Two or more of same type of data cannot be recorded.)	Push the [ENTER] knob to overwrite same data type on the card, or press the [CLEAR] key to escape.

6.1.3 Playing back data from a memory card

Data (track, marks, lines, waypoints, routes and setting data) can be loaded from a memory card and displayed on the screen. This feature is useful for observing past data and setting up the equipment for a specific purpose with "setting data."

1. Press the [MENU] key followed by the SYSTEM CONFIGURATION and DATA TRANSFER soft keys.
2. Press the UPLOAD/DOWNLOAD DATA soft key.
3. Press the LOAD DATA IN MEMORY CARD soft key to show the LOAD DATA menu.



* = Plotter data only

Load data menu

4. Use the trackball to select item to load.
5. Press the EDIT soft key. (The EDIT soft key is inoperative when no memory card is inserted or there is no data in the memory card.)
6. Use the trackball to select ON. (Select OFF to not load selected data.) Press the ENTER soft key. If the memory card does not contain the item selected, the unit beeps and ON cannot be selected.
7. After selecting all items desired, press the LOAD soft key, then press the [ENTER] knob. The message "NOW LOADING FROM MEMORY CARD." appears.
8. After loading is completed, the message "COMPLETED LOADING DATA. PUSH ENTER KNOB TO CONTINUE." appears. Push the [ENTER] knob.

Notes on loading data

Tracks: Since loaded track data is added to internal track, oldest track will be erased when the track memory capacity is exceeded.
Waypoints & routes: The loaded data replaces previously stored data.
Marks & lines: The loaded data is added to internal data. When the mark/line memory becomes full no marks may be entered.
Setting data: The loaded data replaces current configuration settings. If the memory card is ejected while loading or data could not be loaded, push the [ENTER] knob to restart with default settings. Note that track memory capacity is not saved or loaded. To use loaded setting data, turn the power off and on again.

6.2 Uploading, Downloading Data

You can upload/download waypoints, routes, marks and lines from/to a PC, through the DATA 4 port at the rear of the display unit. Note that radar and sounder data cannot be uploaded or downloaded.

6.2.1 Setting communication software on the PC

The communication format (RS-232C) with the PC is as follows:

Baud Rate:	4800 bps
Character Length:	8 bits
Stop bit:	1 bit
Parity:	None
X Control:	XON/XOFF (fixed)

The following data can be downloaded/uploaded between a PC and this equipment:

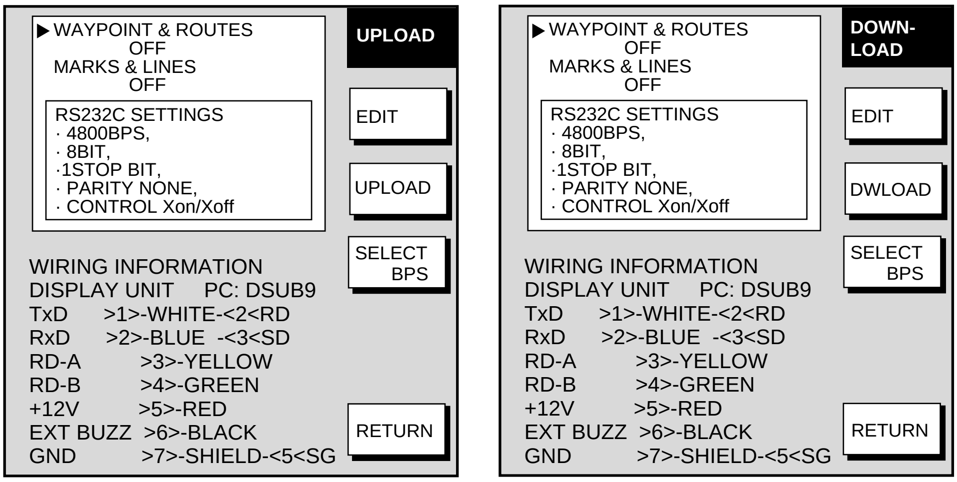
- Waypoint data (In alphanumeric order)
- Route data (In order of route number)
- End of sentence

Note 1: There are two kinds of data for route data: route data and route comment data.

Note 2: Wiring information appears on the UPLOAD or DOWNLOAD menu.

6.2.2 Uploading or downloading data

1. Connect the PC to the equipment.
2. Press the [MENU] key to show the main menu.
3. Press the SYSTEM CONFIGURATION soft key.
4. Press the DATA TRANSFER soft key.
5. Press the UPLOAD/DOWNLOAD DATA soft key.
6. Press the DOWNLOAD WPT/ROUTE TO PC or UPLOAD WPT/ROUTE FROM PC soft key.



Upload and download menus

7. To change the baud rate, press the SELECT BPS soft key.

```
BAUD RATE
▲
⦿ 4800 bps
○ 9600 bps
○ 19200 bps
▼
```

Baud rate window

8. Select baud rate, then press the ENTER soft key.
9. Press the DWLOAD or UPLOAD soft key. You are asked if you are ready to download or upload waypoints and routes.
10. Push the [ENTER] knob to download or upload.

Waypoint data format

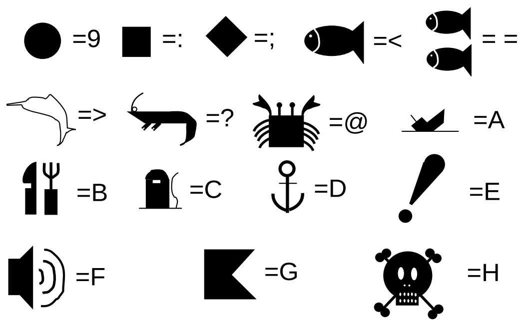
```
PFEC, GPwpl, llll.llll, a, yyyyy.yyy, a, c----c, c, c----c, a <CR><LF>
                 1      2      3      4    5     6    7     8
```

Waypoint data format

1: Waypoint latitude
2: N/S
3: Waypoint longitude
4: E/W
5: Waypoint name (Number of characters is fixed to 6 and space code is placed when the number of characters are less than 6.)
6: Waypoint color
7: Waypoint comment (1 byte for mark code + 13 characters of comment.)
   1st byte of mark code: Fixed to “@”.
   2nd byte of mark code: Internal mark code. See Note 1.
8. Information of marking waypoint. Always set to “A”.
   “A”: Displayed
   “V”: Not displayed

Note 1: The following characters can be used for comments:

_ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789&'#



Characters available for comment

Route data menu

```
$GPRTE, x, x, a, ccc, c----c,  c----c, ... , c----c <CR><LF>
        1  2  3   4     5        6            12
```

Route data format

1: Number of sentences required for one complete route data (1 to 4). See Note 2.
2: Number of sentences currently used (1 to 4)
3: Message mode (Always set to C)
4: Route No. (001 to 300, 3 digits required)
5 through 12: Waypoint name (Max. 8 names, length of each waypoint name is fixed to 7 byte)

Note 2: A route can may contain 35 waypoints, and the GPRTE sentence for one route data may exceed 80 byte limitation. In this case, route data is divided into several GPRTE sentences (Max. 4 sentences). This value shows the number of sentences the route data has been divided.

Route comment data format

```
$PFEC, GPrtc,  xx, c----c <CR><LF>
                1     2
```

Route comment format

1: Route No. (01 to 200, 3 digits required)
2: Route comment (Max. 16 characters, variable length)

The same characters of the comment for waypoint comment can be used.

End of sentence

```
$PFEC, GPxfr,  CTL, E <CR><LF>
```

End of sentence

6.3 Loading Waypoint Data from Yeoman

Waypoint data can be loaded from a Yeoman to this equipment. Connect the Yeoman to a DATA port on this equipment and then follow the procedure below.

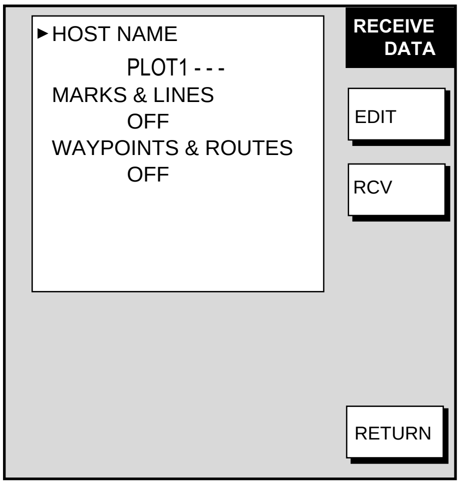
1. Press the [MENU] key.
2. Press the SYSTEM CONFIGURATION key.
3. Press the DATA TRANSFER soft key.
4. Press the RECEIVE YEOMAN DATA soft key.
5. You are asked if you are sure to receive waypoint data from Yeoman equipment. Push the [ENTER] knob to receive the data.

   The message “NOW RECEIVING YEOMAN DATA. PUSH SOFT KEY ‘STOP’ TO STOP RECEIVING.” Is displayed. If waypoint capacity is reached the message “WAYPOINTS FULL. NO MORE WAYPOINT CAN BE RECEIVED. PUSH ANY KEY TO STOP.” appears.
6. To stop receiving, press the STOP soft key.
7. After waypoints have been received, press the [MENU] key to finish.

6.4 Receiving Data Via Network Equipment

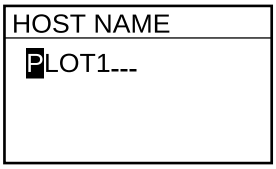
You can receive waypoints, routes, marks and lines from NavNet equipment.

1. Press the [MENU] key.
2. Press the SYSTEM CONFIGURATION soft key.
3. Press the DATA TRANSFER soft key.
4. Press the RECEIVE DATA VIA NETWORK soft key.



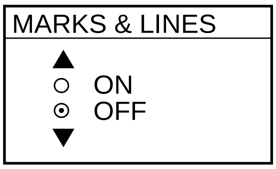
Receive data menu

5. Select HOST NAME, then press the EDIT soft key.



Host name window

6. Use the trackball and the [ENTER] knob to input host name from which to receive data, then push the [ENTER] knob.
7. Select the data you wish to receive, then press the EDIT soft key. For example, select MARKS & LINES.



Marks & lines window

8. Select ON or OFF as appropriate, then press the ENTER soft key.
9. Turn WAYPOINTS & ROUTES on or off as appropriate.

10. Press the RCV soft key, then push the [ENTER] knob.

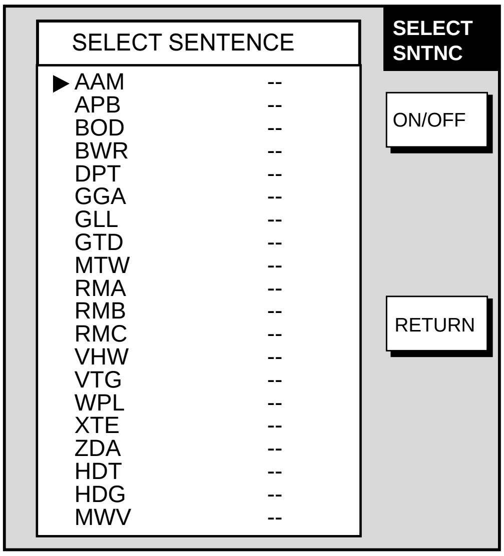
    The message “NOW RECEIVING DATA.” is displayed. If no data could be found, the message “(HOST NAME)’ IS NOT FOUND.” appears.

11. When the transfer is completed, the message “DATA TRANSFER COMPLETED. PUSH ENTER KNOB TO CONTINUE.” appears. Push the [ENTER] knob to finish.
12. Press the [MENU] key to close the menu.

6.5 Outputting Data Through the Network

Follow the procedure below to output data through the network.

1. Press the [MENU] key to open the menu.
2. Press the SYSTEM CONFIGURATION, SYSTEM SETUP, PORT SETUP and OUTPUT THROUGH NETWORK soft keys.



Select sentence menu

3. Select sentence with the trackball.
4. Press the ON/OFF soft key to turn sentence on or off.
5. Press the RETURN soft key.
6. Press the [MENU] key to close the menu.

Note: NMEA heading data cannot be output through the network.

7. MAINTENANCE, TROUBLESHOOTING

This chapter provides information necessary for keeping your unit in good working order and remedying simple problems.

⚠ WARNING

Do not open the equipment.

Hazardous voltage which can cause electrical shock exists inside the equipment. Only qualified personnel should work inside the equipment.

7.1 Preventive Maintenance

Regular maintenance is important for optimum performance. A maintenance schedule should be established and should at least include the items shown in the table below.

Maintenance program

Item	Check point	Remedy
Display unit connectors	Check for tight connection.	Tighten loosened connectors.
CRT	The CRT will, in time, accumulate a coating of dust which tends to dim the picture. Wipe CRT lightly with soft cloth to remove dust.	Do not use chemical cleaners to clean any part of the display unit; they can remove paint and markings.
Ground terminal	Check for tight connection and corrosion.	Clean or replace ground wire as necessary.

7.2 Replacement of Battery

A battery fitted on a circuit board inside the display unit preserves data when the equipment is turned off, and its life is about three years. When its voltage is low the battery icon ( ) appears at the top of the display. When the icon appears, contact your dealer to request replacement of the battery.

Parts Name	Type	Code No.
Lithium battery	CR2450-F2 ST2	000-133-495

7.3 Replacement of Fuse

The fuse on the power cable protects the equipment from reverse polarity of the ship's mains and equipment fault. If the fuse blows, find out the cause before replacing it. Use the correct fuse (10A for 12 V device, 5A for 24 V device). Using the wrong fuse will damage the equipment and void the warranty.

⚠ **CAUTION**

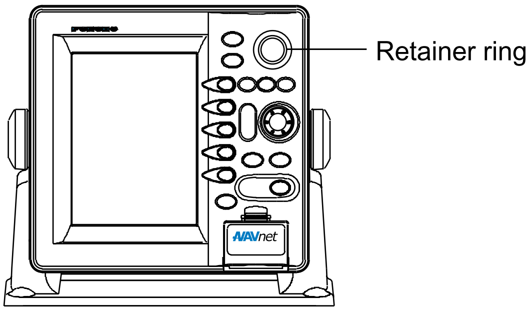
Use the proper fuse.

Use of a wrong fuse can cause fire or damage to the equipment.

7.4 Trackball Maintenance

If the cursor skips or moves abnormally, you may need to clean the trackball.

1. Turn the retainer ring counterclockwise 45° to unlock it.



Display unit

2. Remove the retainer ring and ball.
3. Clean the ball with a soft lint-free cloth, and then blow carefully into the ball-cage to dislodge dust and lint.
4. Look for a build-up of dirt on the metal rollers. If dirty, clean the rollers using a cotton swab moistened lightly with isopropyl-rubbing alcohol.
5. Make sure that fluff from the swab is not left on the rollers.
6. Replace the ball and retainer ring. Be sure the retainer ring is not inserted reversely.

Note: Trackball maintenance parts are available as below.

Part	Type	Code No.
Retainer ring and ball	MU3721	000-144-645

7.5 Simple Troubleshooting

This section provides simple troubleshooting procedures which the user can follow to restore normal operation. If you cannot restore normal operation do not attempt to check inside the unit. Any trouble should be referred to a qualified technician.

7.5.1 General

General troubleshooting

If…	Then…
you cannot turn on the power	• check for blown fuse. • check that the power connector is firmly fastened. • check for corrosion on the power cable connector. • check for damaged power cable. • check battery for proper voltage output (10.8 to 31.2 V).
there is no response when a key is pressed	• turn off and on the power. If there still is no response the key may be faulty. Request service.

7.5.2 Radar

Requires a network radar.

Radar troubleshooting

If…	But…	Then…
you pressed the [POWER/BRILL] key and the RADAR TX soft key to show the radar picture	nothing appears on the display	• check that the antenna cable is firmly fastened. • check if radar source is correct.
marks, legends appear	no echo appears	• check Tx fuse in the power cable. If it is blown, replace it.
the picture is not updated or it freezes	—	• check antenna cable. • for freeze up, turn the display unit off and on again.
tuning is adjusted	sensitivity is poor	• magnetron may need to be replaced. Contact your dealer.
the range is changed	radar picture does not change	• try to hit the [+] and [-] keys again. • turn off and on the display unit.
there is poor discrimination in range	—	• adjust A/C SEA.
the true motion presentation is not working properly	—	• reselect true motion mode. • check if heading and speed are input.
the range rings are not displayed	—	• hit the RADAR DISPLY and RINGS soft keys to display them.

7.5.3 Plotter

Requires GPS Receiver GP-310B.

Plotter troubleshooting

If…	Then…
position is not fixed within three minutes	• check that antenna connector is firmly fastened. • check number of satellites received, on the GPS status display (GPS SENSOR SETTINGS menu, GPS STATUS key. See page 7-11).
position is wrong	• check that the correct geodetic chart system is selected, on the GPS SENSOR SETTINGS menu. • enter position offset, on the GPS SENSOR SETTINGS menu.
track is not plotted	• track is not being plotted. ("H" icon appears at the top of the display.) Press the TRACK HALT soft key on the TRACKS & MARKS CONTROL menu to start plotting again.
bearing is wrong	• check that correct magnetic variation is entered, on the GENERAL SETUP menu.
Loran C (or Decca) TDs do not appear	• check that LORAN C (or DECCA) is selected at TD DISPLAY on the GENERAL SETUP menu. Also, check that proper Loran C (Decca) chains codes are entered, on the TD SETUP menu.
Loran C (or Decca) TDs are wrong	• enter TD offset, on the TD SETUP menu.
ship's speed indication is not zero after the ship is stopped	• try to decrease speed/course smoothing, on the GPS SENSOR SETTINGS menu.

7.5.4 Sounder

Requires Network Sounder ETR-6/10N.

Sounder troubleshooting

If…	But…	Then…
you selected a sounder display with the DISP key	picture does not appear	• check that the network sounder's signal cable is firmly fastened. • Check that sounder source is correct. • check that the network sounder is plugged in. The LED of the network sounder should flash every second.
marks and characters appear	picture does not appear	• check for loosened transducer connector.
picture appears	zero line does not appear	• the picture is shifted. Confirm the shift setting.
picture sensitivity is too low	—	• check gain setting, if using manual operation. • marine life or air bubbles may be clinging to transducer face. • bottom may be too soft to return a suitable echo.
the depth indication is not displayed	—	• adjust gain and range to display the bottom echo, if you are using the manual sounder mode.
noise or interference shows on the display	—	• check to be sure the transducer cable is not near ship's engine. • check the ground. • other video sounders of the same frequency as yours may be operating near you.
the water temperature graph appears	data is wrong	• check that sensor cable is tightly fastened.

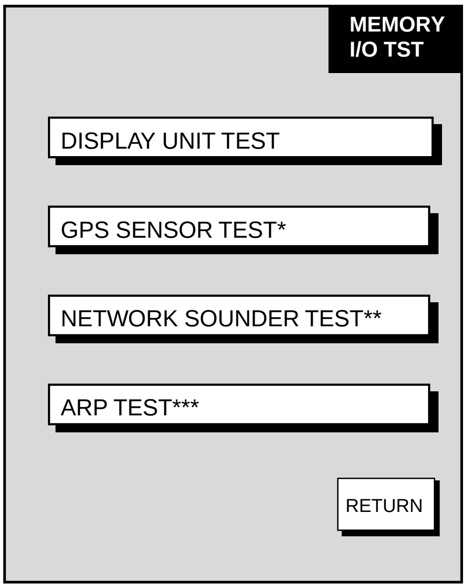
7.6 Diagnostics

This paragraph provides the procedures for testing the equipment for proper operation. Four tests are provided: Memory I/O test, Keyboard test, Remote controller test, and Test pattern.

7.6.1 Memory I/O test

The memory I/O test provides for individual testing of the display unit, GPS Receiver GP-310B, Network Sounder ETR-6/10N and ARP, displaying program number and checking for proper operation.

1. Press the [MENU] key to show the menu.
2. Press the SYSTEM CONFIGURATION soft key.
3. Press the SYSTEM SETUP soft key.
4. Press the TEST & CLEAR soft key.
5. Press the MEMORY I/O TEST soft key.



* = Requires GPS Receiver GP-310B.
** = Requires Network Sounder ETR-6/10N.
*** = Requires ARP-equipped Model 1800/1900 series network radar.

6. Then, press appropriate soft key to start a diagnostic test.

Memory I/O test menu

Display unit test

Press the DISPLAY UNIT TEST soft key at the MEMORY I/O TEST menu to test the display unit. The equipment displays program version number and checks devices. Results for device checks are shown as OK or NG (No Good). For any NG, request service. A test connector is required to check ports. “ - - “ is shown when no test connector is connected. Chart number shown when chart is inserted. Press the RETURN soft key to return the MEMORY I/O TEST menu.

```
PROGRAM No. 03591750XX*
ROM1, 2          : OK
ROM3             : OK
ROM4             : OK
SDRAM            : OK
SRAM             : OK
INT. BATT        : OK
PORT
  NMEA IN/OUT    : --
  NMEA IN        : --
  RS232          : --
  HEADING        : --
  NETWORK        : --
  CHART NUMBER:
H. PULSE         : OK
B. PULSE         : OK
                   (xx.x rpm)
ON TIME          : xxxxxx.x h
TX TIME          : xxxxxx.x h
```

No results appear when "sub" radar selected as radar source. (H. PULSE, B. PULSE)

XX = Program Version No.

* = FURUNO, NAVIONICS model.
03591740XX for C-MAP.

Display unit test results

GPS sensor test (Requires GPS Receiver GP-310B)

Press the GPS SENSOR TEST soft key at the MEMORY I/O TEST menu to test the GPS Receiver GP-310B. The equipment displays GPS receiver program version number, and checks the GPS receiver for proper operation, displaying OK or NG (No Good) as the result. For NG, request service. Press the RETURN soft key to return to the MEMORY I/O TEST menu.

```
PROGRAM No. 4850218XX
GPS UNIT    : OK



Machine Status +115
```

XX = Program Version No.

GPS receiver test results

Network sounder test (Requires Network Sounder ETR-6/10N)

Press the NETWORK SOUNDER TEST soft key at the MEMORY I/O TEST menu to test the Network Sounder ETR-6/10N. The equipment displays network sounder program version number, checks the ROM and RAM, and displays water temperature (appropriate sensor required) and depth. The results of the ROM and RAM check are shown as OK or NG (No Good). For any NG, request service. Press the RETURN soft key to return to the MEMORY I/O TEST menu.

```
PROGRAM No. 02523060XX
ROM             : OK
RAM             : OK
TEMPERATURE
            : 77°F
DEPTH
            : 4000ft
Machine Status +115
```

XX = Program Version No.

Network sounder test results

ARP test (Requires ARP pcb in Model 1800/1900 series network radar)

The ARP test is mainly provided for the service technician. Press the ARP TEST soft key at the MEMORY I/O TEST menu to test the ARP. For any NG, request service. Press the RETURN soft key to return to the MEMORY I/O TEST menu.

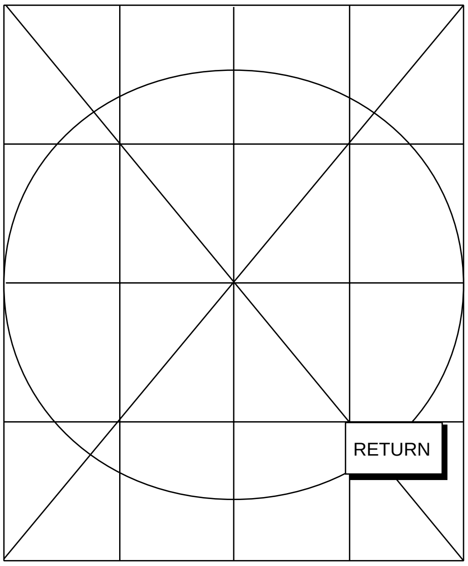
```
PROGRAM No. 18590271XX
ARP ROM         : OK
ARP RAM         : OK
SPEED           : OK 12.3kt
COURSE          : OK 359.9°
TRIGGER         : OK
VIDEO           : OK
BEARING PULSE   : OK
HEADING PULSE   : OK
MINIMUM HIT     : 0003
SCAN-TIME       : 0250
MANUAL ACQ      : 00
AUTO ACQ        : 00
FE-DATA1        : 000
FE-DATA2        : 000

Machine Status +115
```

XX = Program Version No.

ARP test results

7.6.2 Test pattern

1. Press the [MENU] key to show the menu.
2. Press the SYSTEM CONFIGURATION soft key.
3. Press the SYSTEM SETUP soft key.
4. Press the TEST & CLEAR soft key.
5. Press the TEST PATTERN soft key to show the test pattern.



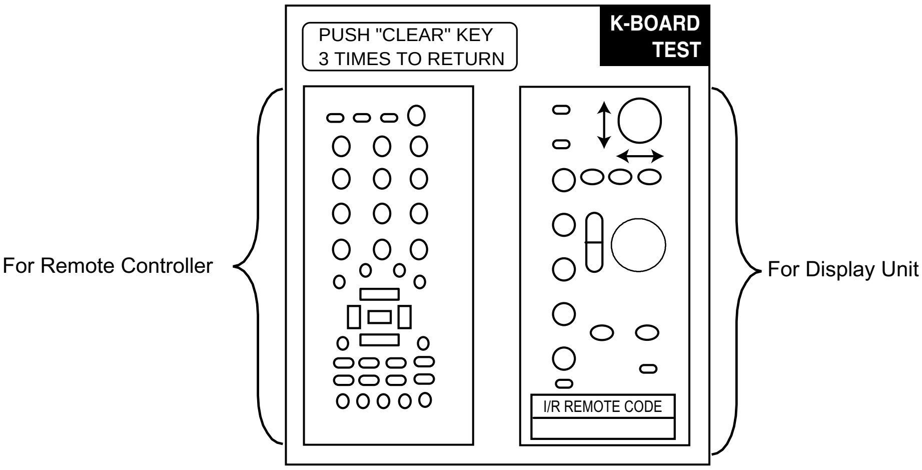
Test patterns

6. Press the RETURN soft key.
7. Press the [MENU] key to close the menu.

7.6.3 Keyboard, remote controller test

The keyboard test checks the controls on the display unit and remote controller for proper operation.

1. Press the [MENU] key to show the menu.
2. Press the SYSTEM CONFIGURATION soft key.
3. Press the SYSTEM SETUP soft key.
4. Press the TEST & CLEAR soft key.
5. Press the KEYBOARD & REMOTE TEST soft key.



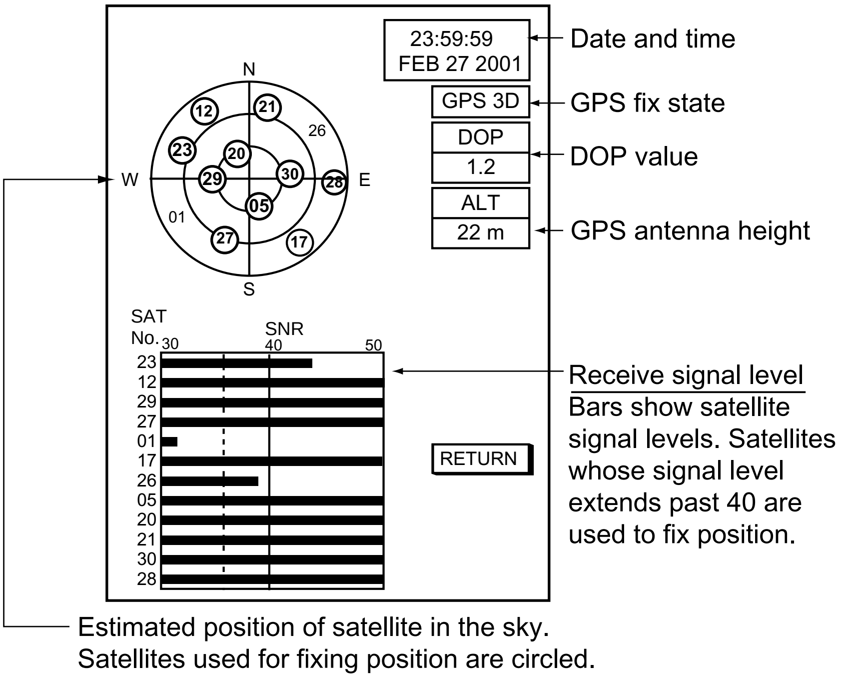
Screen for testing keyboard, remote controller

6. Operate each control on the keyboard and remote controller one by one. A key is functioning properly if its on-screen location “fills” in green when the key is pressed. For the [ENTER] knob and trackball, rotate them to show their X-Y positions digitally, and push the [ENTER] knob to confirm its function.
7. Press the [CLEAR] key on the display unit or remote controller three times to escape from the test.
8. Press the [MENU] key to close the menu.

7.7 GPS Status Display

The GPS status display provides data about the GPS satellites. It is available with connection of the GPS Receiver GP-310B or a GPS navigator outputting the data sentence GSA or GSV.

1. Press the [MENU] key.
2. Press the SYSTEM CONFIGURATION, NAV OPTION and GPS SENSOR SETTINGS soft keys to display the GPS SENSOR SETTINGS menu.
3. Press the GPS STATUS soft key.



GPS status display

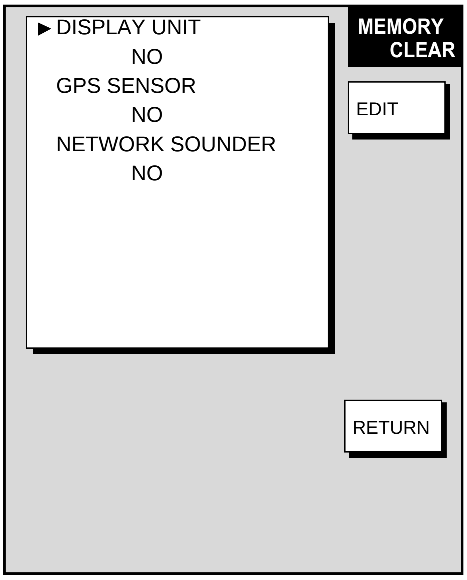
4. Press the RETURN soft key to quit the GPS status display.

7.8 Clearing Memories

Your equipment has a memory for each of the plotter, radar and sounder sections. These memories can be cleared to start operation with default settings.

The following data are not cleared: Heading adjustment, timing adjustment, MBS level, tuning point, tuning indication (short, medium, long), video level, dead sector, antenna height, STC curve, antenna type, on time, tx time.

1. Press the [MENU] key to open the menu.
2. Press the SYSTEM CONFIGURATION soft key.
3. Press the SYSTEM SETUP soft key.
4. Press the TEST & CLEAR soft key.
5. Press the MEMORY CLEAR soft key.



Memory clear menu

6. Use the trackball to choose the memory to clear.
7. Press the EDIT soft key.
8. Use the trackball to select YES, then press the ENTER soft key. One of the following displays appears depending on the selection made at step 6.

Display Unit Clear	GPS Receiver Clear	Network Sounder Clear
ALL SETTNGS EXCEPT SNDR ARE RESET TO DEFAULT. ARE YOU SURE? YES ... PUSH ENTER KNOB NO ... PUSH CLEAR KEY	BEGIN COLD START TO CLEAR GPS MEMORY. ARE YOU SURE? YES ... PUSH ENTER KNOB NO ... PUSH CLEAR KEY	SOUNDER WILL BE SET TO DEFAULT. ARE YOU SURE? YES ... PUSH ENTER KNOB NO ... PUSH CLEAR KEY

Windows for clearing memory

9. Push the [ENTER] knob to clear memory selected.
10. Turn the power off and on again.

7.9 Error Messages

In addition to alarm messages your equipment also displays error messages to alert you to .

Error messages

Error Message	Meaning	Remedy
Connection with the ETR was cut.	Network sounder disconnected.	• Check that display unit where the sounder is connected is turned on. • Check network sounder's cabling.
Connection with the RADAR was cut.	Radar disconnected.	• Check that display unit where the radar is connected is turned on. • Check antenna cable.
Low Voltage! Internal Battery	Voltage of battery on circuit board in display unit is low.	Have a qualified technician replace the battery.
No bearing pulse detected.	No bearing pulse from radar antenna.	Check antenna cable.
No GPS fix!	GPS navigator is turned off or no GPS position data.	Check GPS navigator.
No heading pulse detected.	No heading pulse	Check heading sensor.

APPENDIX

Menu Overview

MENU key

Radar

MENU Key

- RADAR DISPLAY SETUP
  - EBL REFERENCE (TRUE, ***RELATIVE***)
  - CURSOR POSITION (LAT/LON, TD, ***RNG&BRG-REL***, RNG&BRG-TRUE)
  - TUNING (***AUTO***, MAN)
  - TX SECTOR BLANKING (ON (FROM 000°, SECTOR 001°)), ***OFF***)
  - NOISE REJECTION (ON, ***OFF***)
  - 2ND ECHO REJECTION (***OFF,*** LOW, HIGH)
  - WATCHMAN TIME (***5***, 10, 20 minutes)
  - RANGE UNIT (***nm***, km, sm)
  - TRAIL MODE (TRUE, ***RELATIVE***)
  - D. BOX soft key (DATA BOX SIZE ***SMALL***/LARGE, ***POSITION***, WAYPOINT, ***COG***, ***SOG***, STW, BEARING, RANGE, TIME TO GO, ETA, TEMPERATURE, DEPTH, ***TRIP LOG***, DATE, TIME, WIND)
- RADAR RANGE SETUP
  - NM & sm range (***0.125***/***0.25***/***0.5***/***0.75***/1/***1.5***/2/***3***/4/***6***/8/***12***/16/***24***/***36***/***48***/64)
  - km range (***0.25***/***0.5***/***0.75***/***1***/1.5/***2***/3/***4***/6/***8***/12/***16***/24/***36***/***48***/64)

  Max. range
  36 nm/sm, km = 1833
  48 nm/sm, km = 1933
  64 nm/sm, km = 1943
- ARP SETUP (Requires ARP circuit board.)
  - ARP TARGET INFO (INTERNAL ARP, ***EXTERNAL ARP,*** OFF)
  - CANCEL ALL TARGETS (YES, ***NO***)
  - APP VECTOR MODE (***TRUE***, RELATIVE)
  - ARP VECTOR TIME (30 seconds; 1, 3, 6, 15, ***30 minutes***)
  - HISTORY INTERVAL (***OFF***, 30 seconds; 1, 3, 6 minutes)
  - CPA (***OFF***, 0.5, 1, 2, 3, 5, 6 nm)
  - TCPA (***30 seconds***; 1, 2, 3, 4, 5, 6, 12 minutes)
  - AUTO ACQUISITION AREA (ON, ***OFF***)
  - TARGET ID NUMBER (ON, ***OFF***)
- FUNCTION KEY SETUP*
  - SOFT KEY 1 - SOFT KEY 5 (OFF, HDG LINE OFF, MODE, GAIN, A/C SEA, A/C RAIN, FTC (Model 1700 series NavNet radar only), ECHO STRETCH, PULSE LENGTH, ZOOM, OFFCENTER, ECHO TRAIL, RINGS ON/OFF, TLL OUTPUT, GUARD ALARM, EBL, VRM, TTM ON/OFF, WPT ON/OFF, WATCHMAN, ACQUISITION (ARP-equipped Model 1800/1900 series NavNet radar only), STBY/TX, RADAR SOURCE, D. BOX ON/OFF, CHANGE CNTRL)

(1)

* Default settings for function keys:
SOFT KEY 1, HDG LINE OFF; SOFT KEY 2, RINGS ON/OFF; SOFT KEY 3, ECHO TRAIL; SOFT KEY 4, OFFCENTER, SOFT KEY 5, RADAR SOURCE

(1)

- SYSTEM CONFIGURATION
  - GENERAL SETUP
    - Page 1
    - KEY BEEP (***ON***, OFF)
    - LANGUAGE (***ENGLISH***, OTHERS)
    - RANGE UNIT (***nm, kt;*** km, km/h; sm, mph; nm&yd, kt; nm&m, kt; km&m, km/h; sm&yd, mph)
    - TEMPERATURE UNIT (°C, °***F***)
    - DEPTH UNIT (m, ***ft***, fa, pb)
    - TEMPERATURE SOURCE (ETR, ***NMEA***)
    - DEPTH SOURCE (ETR, ***NMEA***)
    - RESET TRIP LOG (YES, ***NO***)
    - Page 2
    - LAT/LON DISPLAY (DD° MM. MM', DD° MM. MMM' ***DD°MM. MMMM'*** DD° MM' SS.")
    - TD DISPLAY (***LORAN C***, DECCA)
    - SPEED (***SOG***, STW)
    - POSITION DISPLAY (***LAT/LON***, TD)
    - TIME DISPLAY (12 HOURS, ***24 HOURS***)
    - INFRARED REMOTE MODE (***A***, B, C, D)
    - RANGE & BEARING MODE (GREAT CIRCLE, ***RHUMB LINE***)
    - BEARING READOUT (TRUE, ***MAGNETIC***)
    - MAGNETIC VARIATION (***AUTO, 0.70°W,*** MANUAL)
    - VIDEO BOOST TIME (3, ***5***, 10 15 min)
  - NAV OPTION
    - NAV SOURCE SETTINGS
      - POSITION SOURCE (FURUNO BB GPS, GP, LC, ***ALL***)
      - SPEED AVERAGING (0-9999 seconds, ***60 seconds***)
      - LOCAL TIME OFFSET (-13:30-+13:30 hr, ***00:00***)
      - TEMP CALIBRATION (-40°F - +40°F, ***0°F***)
      - DEPTH CALIBRATION (-15 - +90 ft, ***0 ft***)
    - GPS SENSOR SETTINGS
      - LOCAL TIME OFFSET (-13:30-+13:30, ***00:00***)
      - GEODETIC DATUM (***WGS-84***, OTHERS: See page A-10.)
      - POSITION SMOOTHING (0 - 999 seconds, ***0 seconds***)
      - SPD/CSE SMOOTHING (0 - 999 seconds, ***5 seconds***)
      - GPS SPEED AVERAGING (0 - 999 seconds, ***60 seconds***)
      - LATITUDE OFFSET (0.000 - 9.999'N(S), ***0.000'N***)
      - LONGITUDE OFFSET (0.000 - 9.999'W(E), ***0.000'E)***
      - DISABLE SATELLITE (Max. 3)
      - LATITUDE (***45°35.000***'N)
      - LONGITUDE (***125°00.000***'W)
      - ANTENNA HEIGHT (0 - 999 m, ***5 m***)
      - GPS FIX MODE (2D, ***2D/3D***)
      - COLD START (YES, ***NO***)
      - GPS STATUS soft key (Displays status of GPS satellites.)
    - TD SETUP
      - LORAN-C GRI (***9940: 11-27*** (***US west coast***))
      - CORRECTION 1 (-999.9-+999.9 µs, ***000.0 µs***)
      - CORRECTION 2 (-999.9-+999.9 µs, ***000.0 µs***)
      - DECCA CHAIN (***01: R-G (South Baltic***))
      - CORRECTION 1 (-99.99-+99.99 lane, ***00.00 lane***)
      - CORRECTION 2 (-99.99-+99.99 lane, ***00.00 lane***)

(2)

(2)

- SYSTEM SETUP
  - PORT SETUP
    - GPS/NMEA PORT
      - FURUNO GPS SENSOR (***YES***, NO)
      - OUTPUT FORMAT (NMEA Ver.1.5, ***2.0***)
      - LAT/LON FORMAT (DD° MM. MM' ***DD° MM. MMM'*** DD° MM. MMMM')
      - OUTPUT DESTINATION (YES, ***NO***)
      - SELECT SNTNC soft key*1
    - PC/NMEA/ EXT. BUZZ PORT
      - NMEA OUTPUT FORMAT (NMEA Ver.1.5, ***2.0***)
      - BAUD RATE (***4800***, 9600, 19200 bps)
      - BIT LENGTH (7 bits, ***8 bits***)
      - STOP BIT (***1 bit***, 2 bits)
      - PARITY(EVEN, ODD, ***NONE***)
      - SELECT SNTNC soft key*1
    - OUTPUT THROUGH NETWORK — Select data sentences to to output through the network. See *1 below for sentences. All sentences are turned off in the default setting.

*1 = AAM, **APB**, BOD, BWR/BWC#1, DPT/DBT#2, GGA, **GLL**, GTD, MTW, RMA, **RMB**, **RMC**, VHW, **VTG**, WPL, XTE, **ZDA**, HDT, HDG, MWV

#1 =BWR with rhumb line; BWC with great circle

#2 =DPT with NMEA 0183 Ver. 2.0; DBT with NMEA0183 Ver. 1.5.

(4) (3)

(4) (3)

- (3)
  - TEST & CLEAR
    - MEMORY I/O TEST
      - DISPLAY UNIT TEST
      - GPS SENSOR TEST*
      - NETWORK SOUNDER TEST**
      - ARP TEST***
    - KEYBOARD & REMOTE TEST
    - TEST PATTERN
    - MEMORY CLEAR
      - DISPLAY UNIT (YES, ***NO***)
      - GPS SENSOR (YES, ***NO***)*
      - NETWORK SOUNDER (YES, ***NO***)**
  - HOT PAGE & NAV DISP SETUP
    - HOT PAGE SETUP (Sets up hot page 1 to 5.)
    - NAV DATA DISPLAY SETUP (Configures nav data displays.)
  - SIMULATION SETUP
    - RADAR (SIMULATION 1, SIMULATION 2, ***LIVE***)
    - PLOTTER (SIMULATION, ***LIVE***)
    - SOUNDER (SIMULATION 1, SIMULATION 2, ***LIVE***)
    - SPEED (0.0-99 kt, ***0.0 kt***)
    - COURSE (8 FIGURE, DIRECTION 0.0°-359.9°, ***0.0***°)
    - LATITUDE (85°0.0'N-85°0.0', ***45***°***35.000'N***)
    - LONGITUDE (180°0.0'E-180°0.0'W, ***125***°***00.000'W***)
    - START DATE & TIME (***00:00, 01.ARP.00***)
    - RADAR SIMULATION DATA (YES, ***NO***)

* = Requires GPS Receiver GP-310B.
** = Requires Network Sounder ETR-6/10N.
*** = Requires ARP-equipped Model 1800/1900 series network radar.

- (4)
  - DATA TRANSFER
    - UPLOAD/ DOWNLOAD DATA
      - DOWNLOAD WPT/RTE TO PC (WAYPOINTS & ROUTES, MARKS & LINES)
      - UPLOAD WPT/RTE FROM PC (WAYPOINTS & ROUTES, MARKS & LINES)
        - (for both of the above) SELECT BPS soft key: ***4800***, 9600, 19200 (bps)
      - SAVE DATA TO MEMORY CARD (TRACKS, MARKS & LINES, WAYPOINTS & ROUTES, SETTING DATA)
      - LOAD DATA IN MEMORY CARD (TRACKS, MARKS & LINES, WAYPOINTS & ROUTES, SETTING DATA)
    - RECEIVE YEOMAN DATA (Receives waypoint data from Yeoman.)
    - RECEIVE DATA VIA NETWORK
      - HOST NAME (PLOT1)
      - MARKS & LINES (***OFF***, ON)
      - WAYPOINTS & ROUTES (***OFF***, ON)

Plotter

- MENU Key ①
  - CHART SETUP ②
    - CHART OFFSET (offsets chart position.)
    - TRACKS & MARKS CONTROL
      - OWN SHIP TRACK DISP (***ON***, OFF)
      - TARGET TRACK DISPLAY (***ON***, OFF)
      - INTERVAL (***TIME***, DISTANCE)
      - TIME INTERVAL (0 - 99m59s, ***10 seconds***)
      - DISTANCE INTERVAL (0 - 99.99nm/km/sm, ***0.1 nm***)
      - MEMORY (TRACK & MARK) (0 - 8000 points, ***2000 points***)
        - TRACK soft key (***RESUME***, HALT)
      - ERASE T & M soft key
        - ERASE ALL TRACKS
        - ERASE TRACKS BY AREA
        - ERASE TARGET TRACKS
        - ERASE ALL MARKS/LINES
        - ERASE MARKS BY AREA
      - MARK SETUP soft key
        - MARKS SHAPE (○ □ ◇ × ⌂ ⊔ •)
        - LINES STYLE (⁝, ———, • • • • • •, • — • —)
        - MARKS SIZE (***LARGE***, SMALL)
    - CHART DETAILS (FURUNO & NavCharts™)
      - LAT/LON GRID (***ON***, OFF)
      - TEXT INFORMATION (***ON***, OFF)
      - WAYPOINTS (***LARGE***, SMALL, OFF)
      - WAYPOINT NAMES (***ON***, OFF)
      - CHART BORDER LINES (***ON***, OFF)
      - LANDMASS (***BRIGHT***, DIM, OFF)
      - NAVAIDS (***ON***, OFF)
      - LIGHT SECTOR INFO (***ON***, OFF)
      - OTHER SYMBOLS (***ON***, OFF)
      - MARK SIZE (***LARGE***, SMALL)
      - CNTOUR LINE soft key
        - DEPTH < 10m (***ON,*** OFF)
        - DEPTH = 10m (***ON,*** OFF)
        - DEPTH > 10m (***ON,*** OFF)
        - DEPTH INFORMATION (OFF, ***ON***)

[ ] = Default setting

(1)

(2)

- CHART DETAILS (C-MAP chart)
  - Page 1
    - WAYPOINT (***ON***, OFF)
    - WAYPOINT NAME (***ON***, OFF)
    - LAT/LON GRID (***ON***, OFF)
    - CHART BORDER LINE (***ON***, OFF)
    - PORT & SERVICE (***ON***, OFF)
    - ATTENTION AREA (***ON***, OFF)
    - NAV LANE (***ON***, OFF)
    - LIGHT (***ON***, OFF, NO SECTOR)
    - BUOY & BEACON (***ON***, OFF)
    - SIGNAL (***ON***, OFF)
    - CARTOGRAPHIC OBJECT (***ON***, OFF)
  - Page 2
    - PLACE NAME (***ON***, OFF)
    - COMPASS (***ON***, OFF)
    - TIDE AND CURRENT (***ON***, OFF)
    - NATURAL FEATURE (***ON***, OFF)
    - RIVER & LAKE (***ON***, OFF)
    - CULTURAL FEATURE (***ON***, OFF)
    - LANDMARK (***ON***, OFF)
    - CHART GENERATION (***ON***, OFF)
    - NEW OBJECT (***ON***, OFF)
    - COMPLEX OBJECT ICON (SINGLE, ***MULTIPLE***)
    - INFORMATION LEVEL (***BASIC***, DETAILED)
  - DEPTH INFO soft key (See left margin.)

<u>DEPTH INFO soft key</u>
BATHYMETRIC LINE (***ON***, OFF)
SPOT SOUNDING (***ON***, OFF)
BOTTOM TYPE (***ON***, OFF)
DEPTH AREA LIMIT (***33 ft***)
BATHYMETRIC RANGE (***0-33 ft***)

- PLOTTER SETUP
  - WAYPOINT SWITCHING (PERPENDICULAR, ***ARRVL ALM CRCL***, MANUAL)
  - COURSE VECTOR (VECTOR, ***LINE***, OFF)
  - SET GOTO METHOD (***1 POINT***, 35 POINTS, 35PTS/PORT SVC)
  - D. BOX soft key (Choose data to display in data boxes. Same items as for D. BOX soft key on the RADAR DISPLAY SETUP menu. See page A-2.)

(3)

3

- WAYPOINT/ ROUTE
  - WAYPOINTS
    - LOCAL LIST
    - ALPHANUMERIC LIST
    - WAYPOINT BY CURSOR
    - WAYPOINT BY RNG & BRG
  - ROUTES
    - GOTO
    - NEW ROUTE
    - EDIT ROUTE
    - ERASE ROUTE
  - LOG Destination is required.
    - RESTART
    - STOP/RELEASE
    - RVRSE/FRWD
    - SPEED (SPEED FOR ETA)
      - ***SPEED 010.0 kt*** (0-999.9 kt)
      - GPS AVE, SPEED
    - COORD TYPE
  - CREATE VOYAGE-BASED ROUTE
    - NEW
      - BCK TRK TME
      - BCK TRK DIST
      - MANUAL
    - SELECT ROUTE
- FUNCTION KEY SETUP*
  - SOFT KEY 1 - SOFT KEY 5 (OFF, ADD NEW WPT, MOVE WPT, RULER, GOTO WPT, GOTO ROUTE, EDIT MK/LINE, TRACK ON/OFF, TTM ON/OFF, DEL TGT TRK, ALPHA LIST, LOCAL LIST, ROUTE LIST, DATA BOX ON/OFF, CHANGE CNTRL) (Assigns function of each plotter function key.)

  * Defaut settings for function keys:
  SOFT KEY 1, TRACK ON/OFF; SOFT KEY 2, EDIT MARK/LINE:
  SOFT KEY 3, RULER; SOFT KEY 4, ADD NEW WPT;
  SOFT KEY 5, ALPHA LIST
- SYSTEM CONFIGURATION (Same items as on page A-2.)

Sounder

MENU Key
- SOUNDER MENU
  - NOISE LIMITER (***OFF***, LOW, MEDIUM, HIGH)
  - CLUTTER (0-16, ***AUTO***)
  - ZOOM MARKER (***ON***, OFF)
  - SIGNAL LEVEL (***OFF***, SL1, SL2, SL3)
  - PICTURE ADVANCE (2/1, ***1/1***, 1/2, 1/4, 1/8, 1/16, STOP)
  - TEMPERATURE GRAPH (ON, ***OFF***)
  - SPD SENSING PIC ADV (ON, ***OFF***)
  - D. BOX soft key (Same items as on plotter menu. See page A-2.)
- SOUNDER SYSTEM SETUP
  - FISH ALARM LEVEL (HIGH, ***MEDIUM***, LOW)
  - TRANSMISSION (***ON***, OFF)
  - TVG 200 kHz (0 - 9, ***3***)
  - TVG 50 kHz (0 - 9, ***3***)
  - ECHO OFFSET 200 kHz (-50 - +50, ***0***)
  - ECHO OFFSET 50 kHz (-50 - +50, ***0***)
  - BOTTOM LEVEL 200 kHz (-100 - +100, ***0***)
  - BOTTOM LEVEL 50 kHz (-100 - +100, ***0***)
  - KP PULSE (***INTERNAL***, EXTERNAL)
  - SMOOTHING (OFF, SM1, SM2, ***SM3***, SM4)
  - TLL OUTPUT (***ON***, OFF)
  - SENSOR SETUP soft key
    - SPEED CALIBRATION (-50 - +50%, ***0%***)
    - TEMP. CALIBRATION (-40°F - +40 °F, ***0°F***)
    - DEPTH CALIBRATION (-15 - +90 ft, ***0 ft***)
    - ACSTC SPD CALIBRATION (-500 - +500m/s, ***0 m/s***)
- SOUNDER RANGE SETUP
  - RANGE 1 - RANGE 8*
  - ZOOM RANGE (2-120 m, ***10 m***; 7-400 ft, ***30 ft***; 1-60 fa, ***10 fa***; 1-70 P/B, ***10 P/B***)
  - BOTTOM LOCK RANGE (3 m, ***6 m***; 10 ft, ***20 ft***; 2 fa, ***3 fa***; 2 P/B, ***3 P/B***)
- FUNCTION KEY SETUP#
  - SOFT KEY 1- SOFT KEY 5
    (OFF, AUTO MODE, GAIN 200 kHz, GAIN 50 kHz, SHIFT, NOISE LIMITER, CLUTTER, WHITE MARKER, HUE, SIGNAL LEVEL, PICTURE ADV, TEMP. GRAPH, TVG 200 kHz, TVG 50 kHz, OFFSET 200K, OFFSET 50K, SMOOTHING, ZOOM RANGE, B/L RANGE, TLL OUTPUT, SNDR SOURCE, D. BOX ON/OFF, CHANGE CNTRL)
    (Assign function of echo sounder function key.)
- SYSTEM CONFIGURATION (Same items as on page A-2.)

* = Default sounder ranges

Range 1	Range 2	Range 3	Range 4	Range 5	Range 6	Range 7	Range 8
5 m	10 m	20 m	40 m	80 m	150 m	300 m	1200 m
15 ft	30 ft	60 ft	120 ft	200 ft	400 ft	1000 ft	4000 ft
3 fa	5 fa	10 fa	20 fa	40 fa	80 fa	150 fa	650 fa
3 P/B	5 P/B	10 P/B	30 P/B	50 P/B	100 P/B	200 P/B	700 P/B

Default settings for function keys:
SOFT KEY 1, TLL OUTPUT; SOFT KEY 2, CLUTTER; SOFT KEY 3, SIGNAL LEVEL:
SOFT KEY 4, NOISE LEVEL, SOFT KEY 5, PICTURE ADV

ALARM key

Radar Alarms

ALARM key
- SET GUARD 1 (ERASE GUARD 1)
- SET GUARD 2 (ERASE GUARD 2)

Plotter Alarms

ALARM key
- AUDIO ALARM (INT & EXT BUZZ, ***INTERNAL BUZZ***, OFF)
- ARRIVAL ALARM (ON, ***OFF***, ***default range: 0.010 nm(km/sm)***)
- ANCHOR WATCH ALARM (ON, ***OFF***, ***default range: 0.010 nm(km/sm)***)
- PROXIMITY ALARM (ON, ***OFF***)
- XTE ALARM (ON, ***OFF***, ***default range: 0.050 nm(km/sm)***)
- SPEED ALARM (WITHIN, UNDER/OVER, ***OFF***)
- TRIP ALARM (ON, ***OFF***)
- BOTTOM ALARM (ON, ***OFF***)
- TEMPERATURE ALARM (WITHIN RANGE, OUT OF RANGE, ***OFF***)
- NEXT INFO soft key (Shows which alarms have been violated.)
- CLEAR ALARM soft key (Acknowledges violated alarm.)

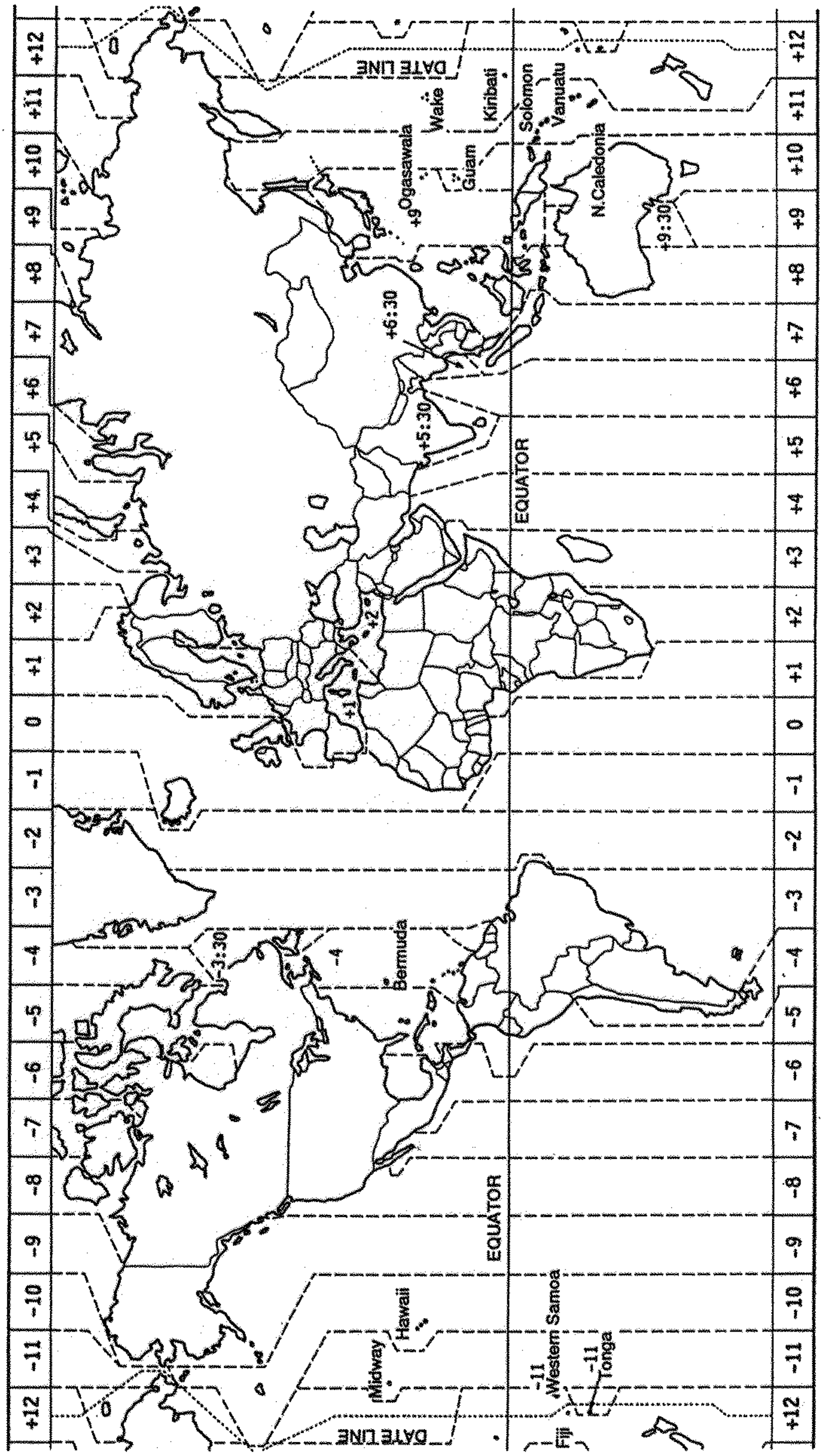
Sounder Alarms

ALARM key
- AUDIO ALARM (INT & EXT BUZZ, ***INTERNAL BUZZ***, OFF)
- BOTTOM ALARM (ON, ***OFF***)
- TEMPERATURE ALARM (WITHIN RANGE, OUT OF RANGE, ***OFF***)
- FISH ALARM (ON, ***OFF***)
- FISH ALARM (B/L) (ON, ***OFF***)
- NEXT INFO soft key (Shows which alarms have been violated.)
- CLEAR ALARM soft key (Acknowledges violated alarm.)

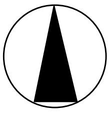
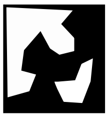
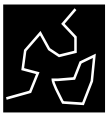
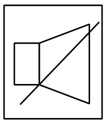
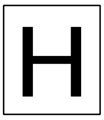
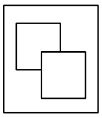
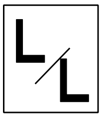
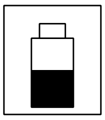
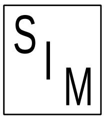
Geodetic Chart List

001: WGS84
002: WGS72
003: TOKYO : Mean Value (Japan, Korea, and Okinawa)
004: NORTH AMERICAN 1927 : Mean Value (CONUS)
005: EUROPEAN 1950 : Mean Value
006: AUSTRALIAN GEODETIC 1984 : Australia and Tasmania Island
007: ADINDAN : Mean Value (Ethiopia and Sudan)
008: : Ethiopia
009: : Mall
010: : Senegal
011: : Sudan
012: AFG : Somalia
013: AIN EL ABD 1970 : Bahrain Island
014: ANNA 1 ASTRO 1965 : Cocos Island
015: ARC 1950 : Mean Value
016: : Botswana
017: : Lesotho
018: : Malawi
019: : Swaziland
020: : Zaire
021: : Zambia
022: : Zimbabwe
023: ARC 1960 : Mean Value (Kenya, Tanzania)
024: : Kenya
025: : Tanzania
026: ASCENSION ISLAND 1958 : Ascension Island
027: ASTRO BEACON "E" : Iwo Jima Island
028: ASTRO B4 SOR. ATOLL : Tem Island
029: ASTRO POS 71/4 : St. Helena Island
030: ASTRONOMIC STATION 1952 : Marcus Island
031: AUSTRALIAN GEODETIC 1966 : Australia and Tasmania Island
032: BELLEVUE (IGN) : Efate and Erromango Islands
033: BERMUDA 1957 : Bermuda Islands
034: BOGOTA OBSERVATORY : Colombia
035: CAMPO INCHAUSPE : Argentina
036: CANTON ISLAND 1966 : Phoenix Islands
037: CAPE : South Africa
038: CAPE CANAVERAL : Mean Value (Florida and Bahama Islands)
039: CARTHAGE : Tunisia
040: CHATHAM 1971 : Chatham Island (New Zealand)
041: CHUA ASTRO : Paraguay
042: CORREGO ALEGRE : Brazil
043: DJAKARTA (BATAVIA) : Sumatra Island (Indonesia)
044: DOS 1968 : Gizo Island (New Georgia Island)
045: EASTER ISLAND 1967 : Easter Island
046: EUROPEAN 1950 (Cont'd) : Western Europe
047: : Cyprus
048: : Egypt
049: : England, Scotland, Channel, and Shetland Islands
050: : England,Ireland, Scotland, and Shetland Islands
051: : Greece
052: : Iran
053: : Italy Sardinia
054: : Italy Sicily
055: : Norway and Finland
056: : Portugal and Spain
057: EUROPEAN 1979 : Mean Value
058: GANDAJIKA BASE : Republic of Maldives
059: GEODETIC DATUM 1949 : New Zealand
060: GUAM 1963 : Guam Island
061: GUX 1 ASTRO : Guadalcanal Island
062: HJORSEY 1955 : Iceland
063: HONG KONG 1963 : Hong Kong
064: INDIAN : Thailand and Vietnam
065: : Bangladesh, India, and Nepal
066: IRELAND 1956 : Ireland
067: ISTS 073 ASTRO 1969 : Diego Garcia
068: JHONSTON ISLAND 1961 : Johnston Island
069: KANDAWALA : Sri Lanka
070: KERGUELEN ISLAND : Kerguelen Island
071: KERTAU 1948 : West Malaysia and Singapore
072: LA REUNION : Mascarene Island
073: L.C. 5 ASTRO : Cayman Brac Island
074: LIBERIA 1964 : Liberia
075: LUZON : Philippines (Excluding Mindanao Island)
076: : Mindanao Island
077: MAHE 1971 : Mahe Island
078: MARCO ASTRO : Salvage Islands
079: MASSAWA : Eritrea (Ethiopia)
080: MERCHICH : Morocco
081: MIDWAY ASTRO 1961 : Midway Island
082: MINNA : Nigeria
083: NAHRWAN : Masirah Island(Oman)
084: : United Arab Emirates
085: : Saudi Arabia
086: NAMIBIA : Namibia
087: MAPARIMA, BWI : Trinidad and Tobago
088: NORTH AMERICAN 1927 : Western United States
089: : Eastern United States
090: : Alaska
091: : Bahamas (Excluding San Salvador Island)
092: : Bahamas San Salvador Island
093: : Canada (Including Newfoundland Island)
094: : Alberta and British Columbia
095: : East Canada
096: : Manitoba and Ontario
097: : Northwest Territories and Saskatchewan
098: : Yukon
099: : Canal Zone
100: : Caribbean
101: : Central America
102: : Cuba
103: : Greenland
104: : Mexico
105: NORTH AMERICAN 1983 : Alaska
106: : Canada
107: : CONUS
108: : Mexico, Central America
109: OBSERVATORIO 1966 : Corvo and Flores Islands (Azores)
110: OLD EGYPTIAN 1930 : Egypt
111: OLD HAWAIIAN : Mean Value
112: : Hawaii
113: : Kaual
114: : Maui
115: : Oahu
116: OMAN : Oman
117: ORDNANCE SURVEY OF GREAT BRITAIN 1936 : Mean Value
118: : England
119: : England, Isle of Man, and Wales
120: : Scotland and Shetland Islands
121: : Wales
122: PICO DE LAS NIVIES : Canary Islands
123: PITCAIRN ASTRO 1967 : Pitcairn Island
124: PROVISIONAL SOUTH CHILEAN 1963 : South Chile (near 53° s)
125: PROVISIONAL SOUTH AMERICAN 1956 : Mean Value
126: : Bolivia
127: : Chile Northern Chie (near 19° s)
128: : Chile Southern Chile (near 43° s)
129: : Colombia
130: : Ecuador
131: : Guyana
132: : Peru
133: : Venezuela
134: PUERTO RICO : Puerto Rico and Virgin Islands
135: QATAR NATIONAL : Qatar
136: QORNOQ : South Greenland
137: ROME 1940 : Sardinia Islands
138: SANTNA BRAZ : Sao Maguel, Santa Maria Islands (Azores)
139: SANTO (DOS) : Espirito Santo Island
140: SAPPER HILL 1943 : East Falkland Island
141: SOUTH AMERICAN 1969 : Mean Value
142: : Argentina
143: : Bolivia
144: : Brazil
145: : Chile
146: : Colombia
147: : Ecuador
148: : Guyana
149: : Paraguay
150: : Peru
151: : Trinidad and Tobago
152: : Venezuela
153: SOUTH ASIA : Singapore
154: SOUTHEAST BASE : Porto Santo and Medeira Islands
155: SOUTHWEST BASE : Faial, Graciosa, Pico, Sao Jorge, and Terceira Islands
156: TIMBALAI 1948 : Brunel and East Malaysia (Sarawak and Sadah)
157: TOKYO : Japan
158: : Korea
159: : Okinawa
160: TRISTAN ASTRO 1968 : Tristan da Cunha
161: VITI LEVU 1916 : Viti Levu Island (Fiji Islands)
162: WAKE-ENIWETOK 1960 : Marshall Islands
163: ZANDERIJ : Suriname
164: BUKIT RIMPAH : Bangka and Belitung Islands (Indonesia)
165: CAMP AREA ASTRO : Camp Mcmurdo Area, Antarctica
166: G. SEGARA : Kalimantan Islands(Indonesia)
167: HERAT NORTH : Afghanistan
168: HU-TZU-SHAN : Taiwan
169: TANANARIVE OBSERVATORY 1925 : Madagascar
170: YACARE : Uruguay
171: RT-90 : Sweden
172 : Pulkovo 1942 : Russia

World Time Chart



Icons

Icon	Meaning
	North marker. Points to North.
	Correct chart and suitable scale - full chart reliability.
	Chart overenlarged.
	Chart card not inserted. Wrong chart card inserted. Chart scale too small.
	Plotter, radar, sounder alarm setting violated.
	Track is not being recorded or plotted.
	Chart offset applied.
	Voyage-based route currently being created.
	Latitude and longitude position offset applied.
	Voltage of battery on circuit board in display unit is low. Contact your dealer about replacement.
	Simulation mode.

INDEX

A

A/C RAIN 2-5
A/C SEA 2-4
ACQ soft key 2-36
ALARM key
- plotter 3-52
- radar 2-30
- sounder 4-17

Alarms
- anchor watch 3-54
- arrival 3-53
- audio 3-52
- bottom 4-18
- CPA/TCPA 2-43
- fish 4-18
- fish(B/L) 4-19
- guard 2-30
- heading data missing 2-8
- lost target 2-44
- messages (plotter) 3-59
- messages (radar) 2-31
- messages (sounder) 4-22
- proximity 3-56
- speed 3-55
- trip 3-57
- water temperature 4-20
- XTE (cross track error) 3-55

Anchor watch alarm 3-54
Antenna height (GPS Receiver GP-310B) 5-22
ARP
- acquisition of targets 2-37
- activating 2-36
- ARP SETUP menu 2-36
- CPA/TCPA alarm 2-43
- data 2-42
- deactivating 2-36
- lost target alarm 2-44
- past position display 2-41
- test 7-8
- tracking termination 2-39
- vector 2-40

Arrival alarm 3-53
A-scope display 4-7
Audio alarm 3-52
AUTO S.SPD soft key 2-21
AUTO/D. BOX soft key 4-8

B

Battery replacement 7-1
Bearing measurement by EBL 2-15
Bearing reference 5-3
Bottom alarm 4-18
Bottom discrimination display 4-6
Bottom echo 4-23
Bottom-lock display 4-6
Bottom-zoom display 4-5
BRILL BOOST soft key 1-9
Brilliance 1-8

C

CENTER soft key 1-14
CHART DETAILS menu 5-12
CHART OFFSET soft key 5-11
Charts
- C-MAP chart attributes 5-13
- cursor and data display (C-MAP) 3-14
- data for aids to navigation 3-12
- FURUNO chart attributes 5-12
- icon data (C-MAP) 3-15
- icons 3-10
- indices 3-10
- inserting 1-6
- NavCharts™ chart attributes 5-12
- offsetting 5-11
- port service icons 3-13
- symbols for FURUNO, NavCharts™ 3-11
- tide information (C-MAP) 3-16

CLEAR ALARM soft key 4-21
Clutter rejector 4-13
C-MAP charts
- attributes 5-13
- cursor and data display 3-14
- icon data 3-15

CNTOUR LINE soft key 5-13
Cold start (GPS Receiver GP-310B) 5-22
Compass display 3-3

Controls
display unit 1-2
remote controller 1-5
Course-up mode
plotter 3-8
radar 2-9
CPA/TCPA alarm 2-43
Cursor
display format 5-4
shifting 1-14
CURSOR soft key 2-19

D

Data boxes
erasing 1-16
hiding 1-16
rearranging 1-16
setup 5-16
showing 1-16
DEPTH INFO soft key 5-15
Depth measurement 4-11
Depth source 5-2
Depth unit 5-2
Diagnostics
ARP test 7-8
display unit test 7-6, 7-7
GPS sensor test 7-7
keyboard test 7-10
network sounder test 7-8
test menu 7-6
test pattern 7-9
DISP key 1-11
Display modes 1-10
Display unit test 7-7
DISPLY MODE soft key 4-2
Downloading data 6-5
Dual frequency display 4-4

E

E. AVG soft key 2-28
E. STR soft key 2-27
EBL reference 5-4
EBL soft key 2-15
EBL/VRM key 2-13, 2-15, 2-22, 2-23
Echo averaging 2-28
Echo offset (sounder) 5-27
Echo stretch 2-27
Echo trails
gradation 2-25
mode 2-26
starting 2-25
time 2-24
Economy mode 1-9
EDIT XT-LMT soft key 3-4, 3-5
ENTER knob 1-4
Error messages 7-13
ETA calculation 3-50

F

Fish alarm
sensitivity 5-26
setting 4-18
Fish alarm (B/L)
sensitivity 5-26
setting 4-19
Fish school echo 4-24
Fix mode (GPS Receiver GP-310B) 5-22
Formatting memory cards 6-1
FREQ 50/200 soft key 4-3
Function keys
function execution 1-17
setup (plotter) 5-9
setup (radar) 5-6
setup (sounder) 5-30
Fuse replacement 7-2

G

GAIN key
radar 2-2
sounder 4-10
GENERAL SETUP menu 5-1
Geodetic datum (GPS Receiver GP-310B) ..5-20
Geodetic datum codes A-10
GPS Receiver GP-310B setup 5-20
GPS sensor (GP-310B) test 7-7
GPS SETUP menu 5-20
GPS status display 7-11
Guard alarm
cancelling 2-31
setting 2-30

H

Heading line 2-16
Head-up mode 2-9
Highway display 3-5
HL OFF soft key 2-16
Hot page setup 5-17

I

I. REJ. soft key....2-18
Icons....A-12
Interference rejection
  radar....2-18
  sounder....4-12

K

Keyboard test....7-10
Keying pulse....5-27

L

Language....5-2
Latitude, longitude display....5-2
Lines
  entering....3-24
  erasing....3-27
  type....3-25
LOAD DATA menu....6-4
Local time
  GPS Receiver GP-310B....5-20
  navigator (GPS, Loran C)....5-19
Lost target alarm....2-44

M

Magnetic variation....5-3
Maintenance
  battery replacement....7-1
  fuse replacement....7-2
  preventive....7-1
  trackball....7-2
Marker-zoom display....4-5
Marks
  entering....3-24
  erasing all....3-26
  erasing individual....3-26
  shape....3-24
Memory
  clearing....7-12
  testing....7-6
Memory cards
  error messages....6-3
  formatting....6-1
  playing back....6-4
  saving data to....6-2
Memory I/O test....7-6
Menu tree....A-1
Messages
  memory cards....6-3
  plotter alarms....3-59
  radar alarms....2-31
  sounder alarms....4-22
MOB mark....1-15
Multiple echoes (radar)....2-47

N

Nav data display....3-6
NAV DATA menu....5-25
Nav data source....5-19
Nav data window....3-2
NAV SETUP menu....5-19
Navigation
  canceling route navigation....3-51
  port, port services....3-46
  quick point....3-44
  restarting....3-49
  routes....3-48
  switching waypoints in a route....3-50
  waypoints....3-45
Navigator setup....5-19, 5-20
NavNet
  image source....1-13
  receiving data from....6-9
Network sounder test....7-8
NEXT INFO soft key....3-58, 4-21
Noise limiter (sounder)....4-12
Noise rejection (radar)....2-17
North marker....2-16
North-up mode
  plotter....3-7
  radar....2-10

O

Offset EBL....2-22
OFFSET soft key....2-22, 2-23

P

Picture advance speed....4-15
PLOTTER SETUP menu....5-8
PLOTTR CNTRL soft key....1-12
Port, port services
  icons....3-13
  navigating to....3-46
Position offset (GPS Receiver GP-310B)....5-21
Position smoothing (GPS Receiver
  GP-310B)....5-21

POWER/BRILL key 1-7, 1-8
Presentation mode
 plotter 3-7
 radar 2-8
Proximity alarm 3-56
Pulselength (radar) 2-7

R

Racon..2-51
RADAR CNTRL soft key 1-12
RADAR SETTING menu................................5-3
RADAR TX/ST-BY soft key............................2-2
Range
 measurement by cursor (radar) 2-12
 measurement by range rings (radar) 2-11
 plotter 3-9
 radar 2-6
 setup (radar) 5-5
 setup (sounder) 5-29
 unit of measurement..................................5-2
RANGE key
 plotter 3-9
 radar 2-6
 sounder..4-9
Remote controller
 control description 1-5
 testing 7-10
RESET XTE soft key...............................3-4, 3-5
RINGS soft key 2-11
Routes
 cancelling navigation of 3-51
 connecting 3-40
 entering with cursor 3-37
 entering with existing waypoints 3-36
 erasing 3-43
 following 3-48
 inserting waypoint from plotter display 3-42
 inserting waypoint from route list..............3-41
 removing waypoint from...........................3-43
 voyage based...3-38

S

SART 2-49
Satellite disable (GPS Receiver GP-310B)...5-22
SAVE DATA menu 6-1
SAVE/MOB key..1-15
Second-track echoes (radar) 2-33
Sensor setup...5-27
SENSOR SETUP menu...............................5-28
SENSOR SETUP soft key 5-27
Shadow sectors 2-48
Shift
 automatic (radar) 2-21
 manual (radar) 2-20
 sounder 4-10
SHIFT soft key 2-20, 4-10
Sidelobe echoes 2-47
Signal level erasure (sounder).....................4-14
SIM SETUP menu 1-18
Simulation display.......................................1-18
Smoothing echoes (sounder) 5-27
Soft keys 1-3
Speed alarm 3-55
Speed averaging
 GPS Receiver GP-310B)..........................5-21
 navigator (GPS, Loran C)........................5-19
Speed display 5-2
Speed/course smoothing (GPS Receiver
 GP-310B) 5-21
SPLIT soft key 4-7
System configuration...x
SYSTEM SETUP menu (sounder) 5-26

T

TARGET INFO soft key................................2-42
TARGET soft key 2-24
TD display...5-2
TD setup
 Decca 5-24
 Loran C..5-23
TD SETUP menu...5-23
Test menu 7-6
Test pattern...7-9
Time measurement (sounder)......................4-11
Time notation...5-2
TLL data output (radar)................................2-29
TLL OUTPUT key 2-29
Track
 displaying other targets'...........................3-19
 displaying own ship's...............................3-18
 erasing all own ship's 3-23
 erasing all targets' 3-23
 erasing own ship's by area.......................3-22
 memory distribution setting 3-21
 plotting interval 3-20
 plotting method..3-20
 plotting of own ship's 3-19

TRACK HALT soft key....3-19
TRACK RESUME soft key....3-19
Trackball maintenance....7-2
Trackball operation....1-14
TRAIL ON/OFF soft key....2-25
TRAIL soft key....2-24
TRAIL TIME soft key....2-24
Trip alarm....3-57
Trip distance resetting....3-60
Troubleshooting....7-3
  plotter....7-4
  radar....7-3
  sounder....7-5
True motion mode....2-10
Tuning....2-2
TVG....5-27
Tx sector (radar)....5-4

U

Uploading data....6-5

V

Vector (ARP)....2-40
Virtual image....2-48
VRM (Variable Range Marker)
  radar....2-13
  sounder....4-11
VRM soft key....2-14, 2-16

W

W. MAN soft key....2-32
Watchman....2-32
Water temperature alarm....4-20
Water temperature graph....4-22
Water temperature unit....5-2
Waypoint marker (radar)....2-34
Waypoints
  changing size....3-34
  editing from waypoint list....3-31
  editing waypoint position....3-32
  editing with cursor....3-32
  entering at own ship position....3-28
  entering by range and bearing....3-30
  entering with cursor....3-28
  erasing from the menu....3-33
  erasing from waypoint list....3-33
  erasing with cursor....3-33
  loading from Yeoman....6-8
  navigating to....3-45
  searching....3-35
  switching in route navigation....3-50
World time chart....A-11
WPT MK soft key....2-34

X

XTE (cross track error) alarm....3-55
XTE monitor....3-4, 3-5

Y

Yeoman....6-8

Z

Zero line....4-23
Zoom....2-19
ZOOM/D. BOX soft key....2-19

SPECIFICATIONS OF MARINE RADAR
MODEL 1833/1933/1943

1. GENERAL

1.1. Indication System — PPI Daylight display, raster scan, monochrome CRT

1.2. Range, Pulse length (PL) & Pulse Repetition Rate (PRR)

Range (nm)	Pulse length (μs)	PRR (Hz approx.)
0.125 to 1.5	0.08	2100
1.5 to 3	0.3	1200
3 to 64*	0.8	600

*Maximum Range: M1833: 36nm, M1933: 48nm, M1943: 64nm

1.3. Range Resolution — 20 m

1.4. Bearing Resolution — M1833: 4.0°, M1933: 2.4°, M1943: 1.9°

1.5. Minimum Range — 27 m

1.6. Bearing Accuracy — ±1°

1.7. Range Ring Accuracy — 0.9 % of range or 8 m, whichever is the greater

2. SCANNER UNIT

2.1. MODEL1833:

2.1.1. Radiator — Printed waveguide array

2.1.2. Polarization — Horizontal

2.1.3. Antenna Rotation — 24 rpm nominal

2.1.4. Radiator Length — 60 cm

2.1.5. Horizontal Beamwidth — 3.9°

2.1.6. Vertical Beamwidth — 20°

2.1.7. Sidelobe Attenuation — -18 dB or less (within ±20° of main-lobe)
-23 dB or less (±20° of main-lobe or more)

2.2. MODEL1933:

2.2.1. Radiator — Slotted waveguide array

2.2.2. Polarization — Horizontal

2.2.3. Antenna Rotation — 24 or 48 rpm nominal

2.2.4. Radiator Length — 100 cm (XN10)

2.2.5. Horizontal Beamwidth — 2.4°

2.2.6. Vertical Beamwidth — 27°

2.2.7. Sidelobe Attenuation — -20 dB or less (within ±20° of main-lobe)
-28 dB or less (±20° of main-lobe or more)

2.3. MODEL1943:

2.3.1. Radiator Slotted waveguide array

2.3.2. Polarization Horizontal

2.3.3. Antenna Rotation 24 or 48 rpm nominal

2.3.4. Radiator Length 120 cm (XN12)

2.3.5. Horizontal Beamwidth 1.9°

2.3.6. Vertical Beamwidth 22°

2.3.7. Sidelobe Attenuation -24 dB or less (within ±20° of main-lobe)
-30 dB or less (±20° of main-lobe or more)

3. TRANSCEIVER MODULE

3.1. Frequency and Modulation 9410 MHz ±30MHz (X band), P0N

3.2. Peak Output Power M1833/1933: 4 kW nominal,
M1943: 6 kW nominal

3.3. Modulator FET Switching Method

3.4. Intermediate Frequency 60 MHz

3.5. Tuning Automatic or manual

3.6. Receiver Front End MIC (Microwave IC)

3.7. Bandwidth Tx pulselength 0.08 μs and 0.3 μs: 25 MHz
Tx pulselength 0.8 μs: 3 MHz

3.8. Duplexer Circulator with diode limiter

3.9. Warming up 90 sec. approx.

4. DISPLAY UNIT

4.1. Picture Tube
M1833 /1933/1943 10-inch rectangular monochrome CRT
640(H) x 481(V) dots, Effective radar display dia.: 130 mm

4.2. Range, Range Ring Interval (RI), Number of Rings

Range (nm)	0.125	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16	24	36	48	64
RI (nm)	0.0625	0.125	0.125	0.25	0.25	0.5	0.5	1	1	2	2	3	4	6	12	12	16
Rings	2	2	4	3	4	3	4	3	4	3	4	4	4	4	3	4	4

Maximum range: M1833: 36nm, M1933: 48nm, M1943: 64nm

4.3. Markers Heading Line, Bearing Scale, Range Rings,
Variable Range Marker (VRM), Electronic Bearing Line (EBL),
Alarm Zone, Waypoint Mark (navigation input required)

4.4. Alphanumeric Indications Range, Range Ring Interval, Interference Rejection (IR),
Variable Range Marker (VRM), Electronic Bearing Line (EBL),
Stand-by (ST-BY) , Echo Averaging (EAV), TX Pulse width

Guard Alarm (G(IN), G(OUT)), Echo Stretch (ES),
Range and Bearing to Cursor or Cursor Position,
Echo Trailing (TRAIL), Trailing Time,
Data Box (Position, COG, SOG, STW etc. selectable on menu)

4.5. Input Data — IEC 61162-1 (NMEA 0183 Ver1.5/2.0)

Own ship's position:	GGA>RMC>RMA>GLL
Ship's speed:	RMC>RMA>VTG>VHW
Bearing (True):	HDT>HDG[*1]>HDM[*1]> VHW
Bearing (Magnetic):	HDM>HDG[*1]>HDT[*1]> VHW
Course:	RMC>RMA>VTG
Waypoint (Range, bearing):	RMB>WPL>BWR>BWC
Water depth:	DPT>DBT>DBS>DBK
Wind:	MWV>VWT>VWR
Water Temperature:	MTW
Time:	ZDA

[*1]: calculated by magnetic deviation

4.6. Output Data

Alarm signal	12 VDC, 100 mA or less
NMEA 0183 Ver1.5	GGA, GLL, RMA, RMC, GTD, VTG, ZDA (GPS data required) RMB, WPL, BWC or BWR, APB, AAM, BOD, XTE, VHW, MTW, DPT or DBT, DBS (ETR required), TLL (L/L, Heading data required), TTM (ARPA required)

5. PLOTTER FUNCTION

5.1.	Projection	Mercator
5.2.	Usable Area	85 latitude or below
5.3.	Effective Area	180 x 134 mm
5.4.	Display pixels	640 x 481 dots
5.5.	Position Indication	Latitude/longitude, Loran C LOP or DECCA LOP
5.6.	Effective Projection Area	0.125 nm to 1,024 nm (at equatorial area)
5.7.	Track Display	Plot interval: by time (1 sec. to 99 min. 59 sec.) or by distance (0 to 99.9 nm)
5.8.	Colors	Red, yellow, green purple, light-blue, blue, white
5.9.	Memory Capacity	Track/mark: 8000 points, Waypoint: 999 points
5.10.	Storage Capacity	Simple route: 200 routes with 35 waypoints each
5.11.	MOB	1 point
5.12.	Quick Routes	1 course with 35 waypoints max.
5.13.	Electronic Chart	FURUNO chart card or NAVIONICS chart card available

	C-MAP chart card also available for C-MAP NT Model
5.14. Alarms	Arrival and Anchor watch, Cross track error and proximity alarms, Ship's speed in and out alarms, Water temperature, Trip alarm, Fish alarm, Bottom alarm (ETR required)

6. POWER SUPPLY

6.1.	Rated Voltage/Current	
	M1833:	12-24 VDC: 5.0-2.5 A
	M1933:	12-24 VDC: 6.5-3.2 A
	M1943:	12-24 VDC: 7.2-3.7 A
6.2.	Rectifier (option)	
	PR-62 (M1833):	100/110/220/230 VAC, 1 phase, 50/60 Hz
	RU-3423 (M1933/1943):	100/110/220/230 VAC, 1 phase, 50/60 Hz

7. ENVIRONMENTAL CONDITION

7.1.	Ambient Temperature	Scanner Unit: -25°C to +70°C
		Display Unit: -15°C to +55°C
		Remote Controller: +5°C to +45°C
7.2.	Relative Humidity	93 % or less at +40°C
7.3.	Waterproofing	Scanner Unit: IPX6
		Display Unit: IPX5 (External monitor connected: IPX0)
		Remote Controller: IPX0
7.4.	Bearing Vibration	IEC 60945-3rd

8. COATING COLOR

8.1.	Display Unit	N3.0
8.2.	Scanner Unit	
	M1833:	N9.5 (upper), 2.5PB3.5/10 (lower)
	M1933/1943	N9.5

9. COMPASS SAFE DISTANCE

9.1.	Display Unit	Standard: 0.85 m	Steering: 0.45 m
9.2.	Scanner Unit		
	M1833	Standard: 0.90 m	Steering: 0.70 m
	M1933/1943	Standard: 1.00 m	Steering: 0.75 m

FURUNO ELECTRIC CO., LTD.
9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan
Tel: +81 798-65-2111 Fax: +81 798-65-4200

Pub NO. DOC-388

Declaration of Conformity

CE 0560

We FURUNO ELECTRIC CO., LTD.

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

declare under our sole responsibility that the product

10" monochrome radar Models 1833 (ø602 mm radome, 4 kW, 24 rpm), 1933 (1035 mm open, 4 kW, 24/48 rpm) and 1943 (1255 mm open, 6 kW, 24/48 rpm) with optional GPS receiver GP-310B for recreational crafts

(Model name, type number(s))

are in conformity with the essential requirements as described in the Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment (R&TTE Directive) and satisfies all the technical regulations applicable to the product within this Directive

EN 60945: 1997-01 (IEC 60945 Third edition: 1996-11)
KSR 142: October 1985, Annex 1
ITU-RR. App. S3: ed. 1998, Appendix S3, table 2

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see

- Statement of Opinion N° 01214053/AA/00 of 27 March 2001 issued by KTL Certification, The Netherlands
- Test report s FLI 12-00-010, FLI 12-01-011, FLI 12-01-012, FLI 12-01-004, FLI 12-01-005, FLI 12-01-006, FLI 12-01-015, FLI 12-01-027 prepared by Furuno Labotech International Co., Ltd., Japan

On behalf of Furuno Electric Co., Ltd.

Hiroaki Komatsu
Manager,
International Rules and Regulations

(name and signature or equivalent marking of authorized person)

Nishinomiya City, Japan
May 25, 2001

(Place and date of issue)